

## **LM-79-08 Test Report**

for

### **GREEN CREATIVE LTD**

756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

### **LED Tube**

**Model: 12T8/3F/840/DEB/R**

### **Laboratory: Leading Testing Laboratories**

**NVLAP CODE: 200960-0**

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Report No.: HZ18120037j

The laboratory that conducted the testing detailed in this report has been accredited for SSL by NVLAP.

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Engineer: April Zou  
Jan. 18, 2019

Approved by:



Manager: Jim Zhang  
Jan. 18, 2019

Note: This report does not imply product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

## Test Summary

Sample Tested: 12T8/3F/840/DEB/R

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
130.0	1496.0	11.51	0.9791
CCT (K)	CRI	Stabilization Time (Light & Power)	
4059	82.5	60	

Table 1: Executive Data Summary

Note: The above results are recorded/ derived from measurements made using an Integrating Sphere.

### Test specifications:

**Date of Receipt** : Dec. 26, 2018

**Date of Test** : Dec. 29, 2018

**Test item** : Total Luminous Flux, Luminous Distribution Intensity, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters

**Reference Standard** : IESNA LM-79-2008 Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products

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## Sample Photos



Figure 1- Overview of the sample

### Equipment Under Test (EUT)

<b>Name</b>	: LED Tube
<b>Model</b>	: 12T8/3F/840/DEB/R
<b>Electrical Ratings</b>	: 120-277V, 50/60Hz, 12W
<b>Product Description</b>	: G13 base, 4000K
<b>Manufacturer</b>	: GREEN CREATIVE LTD
<b>Address</b>	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

## TEST RESULTS

Test ambient temperature was 26.0°C.

Base orientation was horizontal. Test was conducted without a dimmer in the circuit.

The stabilization time of the sample was 60 minutes, and the total operating time including stabilization was 70 minutes.

### Sphere-Spectroradiometer Method

Parameter	Result	
Test Voltage (V)	120.0	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.098	0.046
Power Factor	0.9791	0.9379
Test Power (W)	11.51	11.95
THD A%	18.47	17.36
Luminous Efficacy (lm/W)	130.0	127.0
Total Luminous Flux (lm)	1496.0	1518.0
Color Rendering Index (CRI)	82.5	
R9	7.1	
Correlated Color Temperature (CCT)(K)	4059	
Chromaticity Chroma x	0.3787	
Chromaticity Chroma y	0.3786	
Chromaticity Chroma u	0.2232	
Chromaticity Chroma v	0.3348	
Duv	0.0008	
Chromaticity Chroma u'	0.2232	
Chromaticity Chroma v'	0.5021	

Special Color Rendering Indices	
R1	80.5
R2	88.6
R3	94.6
R4	81.1
R5	80.4
R6	84.1
R7	86.3
R8	64.4
R9	7.1
R10	72.9
R11	79.6
R12	60.4
R13	82.5
R14	97.1
Rf	82
Rg	95

Table 2: Test data per Sphere-Spectroradiometer Method

Note: According to CIE 1976 (u',v') diagram,  $u' = u = 4x/(-2x+12y+3)$ ,  $v' = 3v/2 = 9y/(-2x+12y+3)$ .

### Goniophotometer Method

Test ambient temperature was 24.9°C.

The photometric distance is 30m.

Luminous data was taken at 0.5 °vertical intervals and 10 °horizontal intervals.

Parameter	Result
Test Voltage (V)	120.0
Voltage frequency (Hz)	60
Test Current (A)	0.098
Power Factor	0.9791
Test Power (W)	11.48
Luminous Efficacy (lm/W)	128.7
Total Luminous Flux (lm)	1477.9
Beam Angle ( °)	154.4
Center Beam Candle Power (cd)	265
Spacing Criteria	1.24 (0 °-180 °)/ 1.41 (90 °-270 °)
Zonal Lumens in the 0 °-60 °Zone	44.72%
Zonal Lumens in the 60 °-90 °Zone	26.45%
Zonal Lumens in the 90 °-120 °Zone	16.69%
Zonal Lumens in the 120 °-180 °Zone	12.14%

Table 3: Test data per Goniophotometer Method

## Spectral Power Distribution - Sphere Spectroradiometer Method

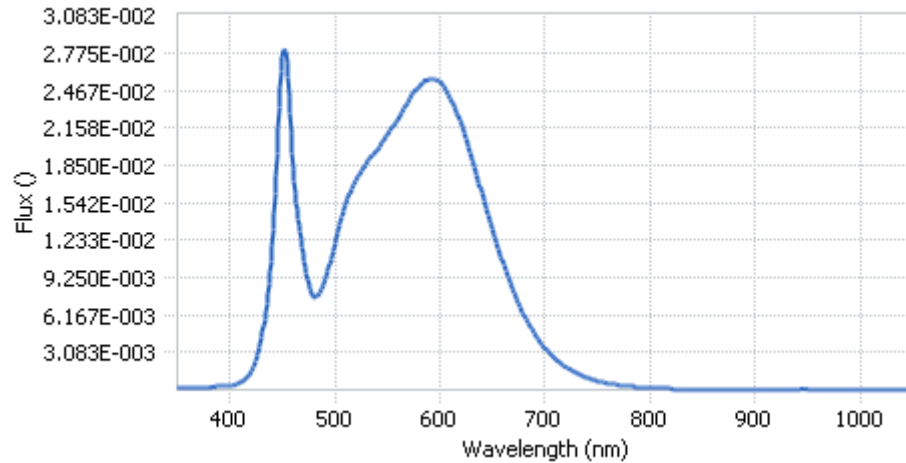
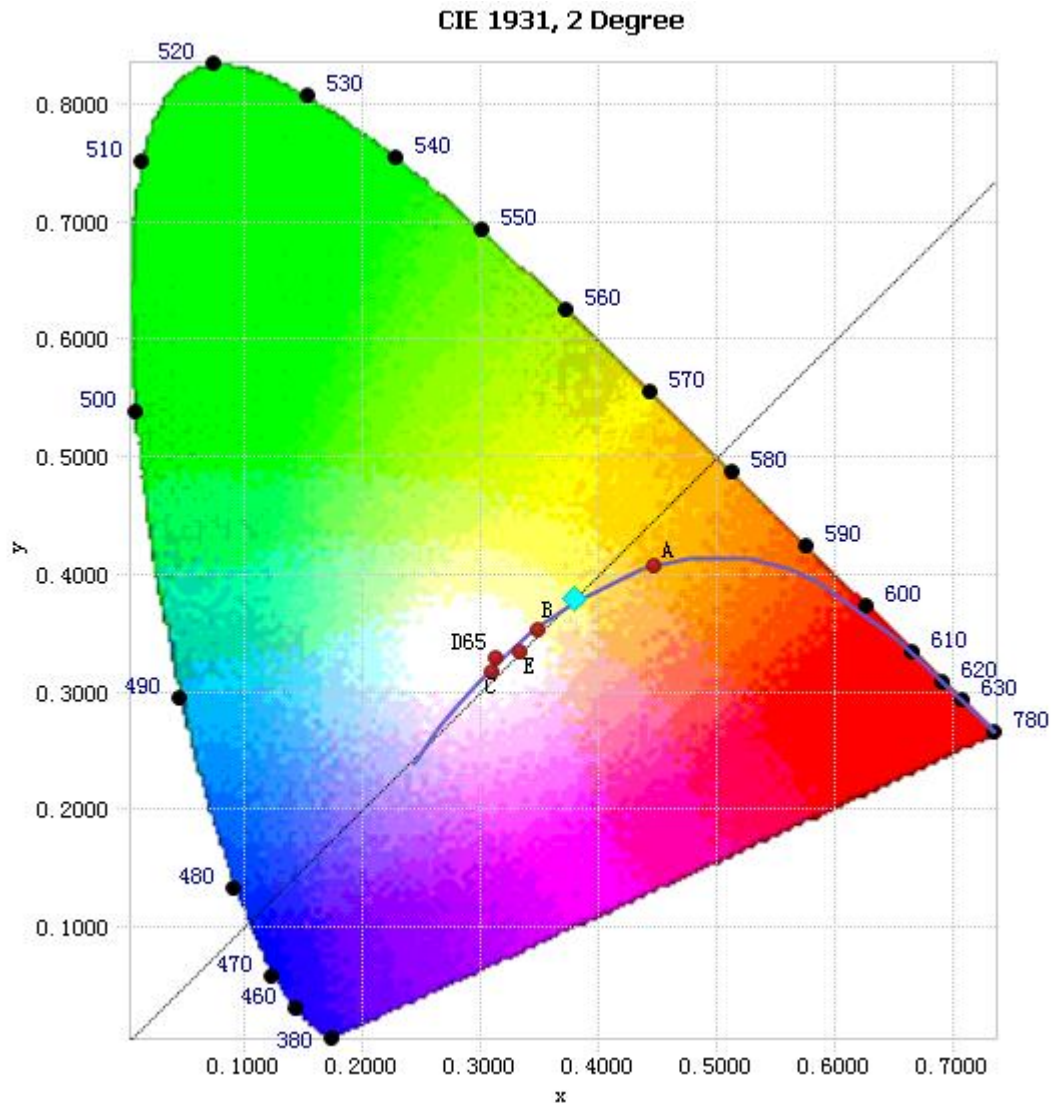


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.63E-04	485	7.96E-03	590	2.56E-02	695	3.99E-03
385	2.51E-04	490	8.88E-03	595	2.55E-02	700	3.45E-03
390	2.87E-04	495	1.04E-02	600	2.53E-02	705	2.97E-03
395	3.20E-04	500	1.21E-02	605	2.48E-02	710	2.55E-03
400	3.53E-04	505	1.38E-02	610	2.40E-02	715	2.18E-03
405	4.39E-04	510	1.52E-02	615	2.31E-02	720	1.89E-03
410	6.15E-04	515	1.65E-02	620	2.19E-02	725	1.61E-03
415	9.39E-04	520	1.74E-02	625	2.06E-02	730	1.38E-03
420	1.51E-03	525	1.81E-02	630	1.92E-02	735	1.18E-03
425	2.54E-03	530	1.87E-02	635	1.77E-02	740	1.01E-03
430	4.28E-03	535	1.93E-02	640	1.61E-02	745	8.65E-04
435	7.17E-03	540	1.98E-02	645	1.46E-02	750	7.41E-04
440	1.18E-02	545	2.04E-02	650	1.32E-02	755	6.41E-04
445	1.96E-02	550	2.10E-02	655	1.18E-02	760	5.55E-04
450	2.74E-02	555	2.17E-02	660	1.05E-02	765	4.83E-04
455	2.57E-02	560	2.24E-02	665	9.23E-03	770	4.11E-04
460	1.82E-02	565	2.31E-02	670	8.09E-03	775	3.50E-04
465	1.41E-02	570	2.38E-02	675	7.07E-03	780	3.07E-04
470	1.12E-02	575	2.44E-02	680	6.17E-03		
475	8.62E-03	580	2.50E-02	685	5.36E-03		
480	7.68E-03	585	2.55E-02	690	4.64E-03		

Table 4: Spectral Power Distribution Numerical Data per Sphere - Spectroradiometer Method

## Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y) : (0.3787,0.3786)

Chart 2: Chromaticity Diagram per Sphere - Spectroradiometer Method

Note: The location on the diagram of the tristimulus coordinates are indicated by the blue diamond.

### Nominal CCT Quadrangles – Sphere Spectroradiometer Method

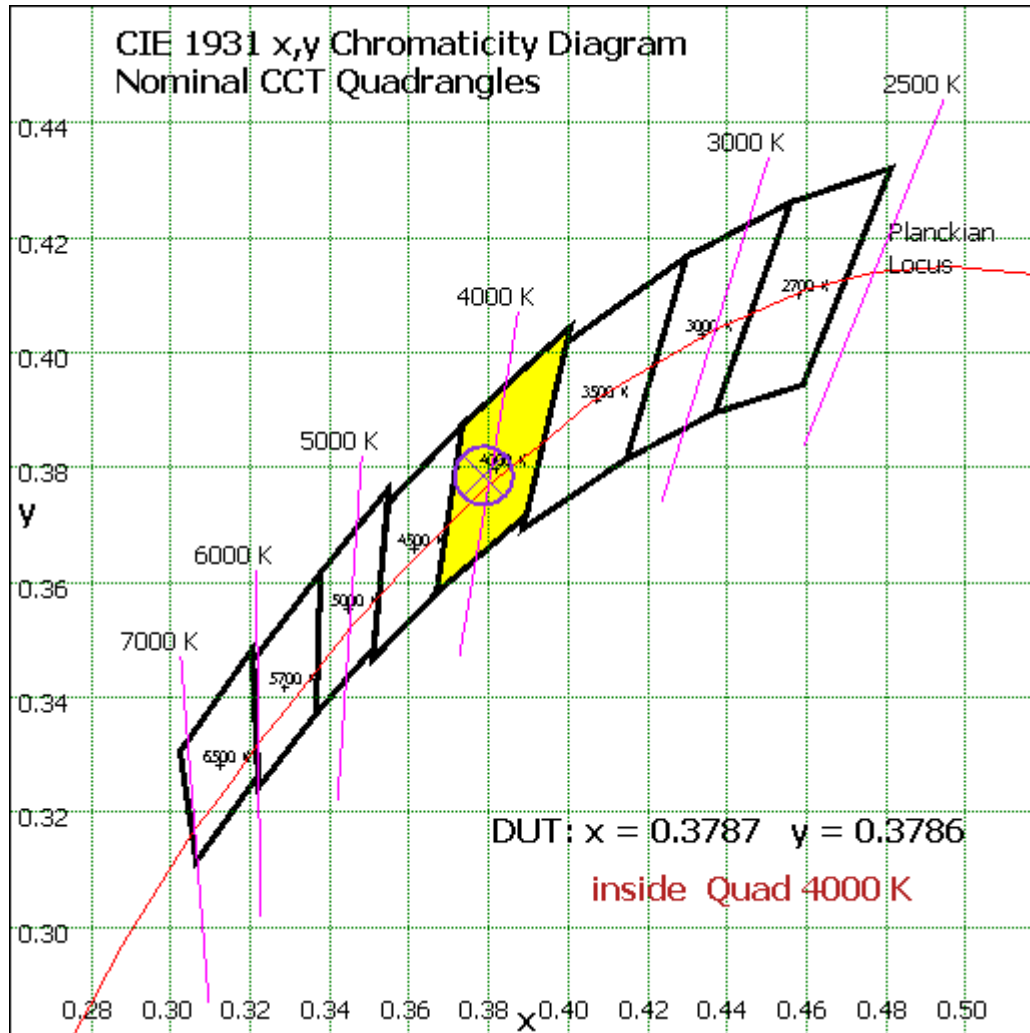


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

### Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	25.121	1.70%
10- 20	72.562	4.91%
20- 30	112.097	7.58%
30- 40	140.041	9.48%
40- 50	154.686	10.47%
50- 60	156.457	10.59%
60- 70	147.309	9.97%
70- 80	131.01	8.86%
80- 90	112.629	7.62%
90-100	96.565	6.53%
100-110	81.766	5.53%
110-120	68.276	4.62%
120-130	56.352	3.81%
130-140	45.62	3.09%
140-150	35.304	2.39%
150-160	24.813	1.68%
160-170	13.589	0.92%
170-180	3.753	0.25%
Total	1478.0	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	660.964	44.72%
60- 90	390.948	26.45%
0-90	1051.912	71.17%
90- 180	426.038	28.83%
0- 180	1478.0	100%

Table 5: Zonal Lumen Data

Note: The Flux in this table might be a little different from the total flux in Table 2 due to rounding.

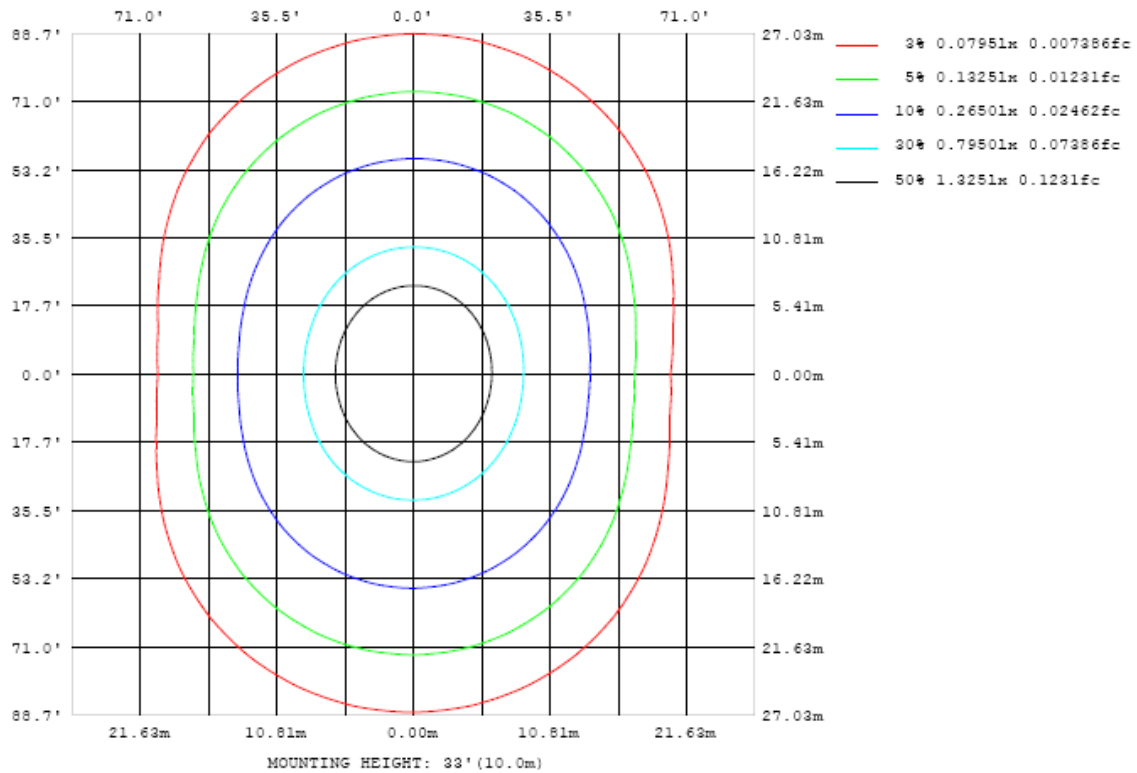


Chart 4: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

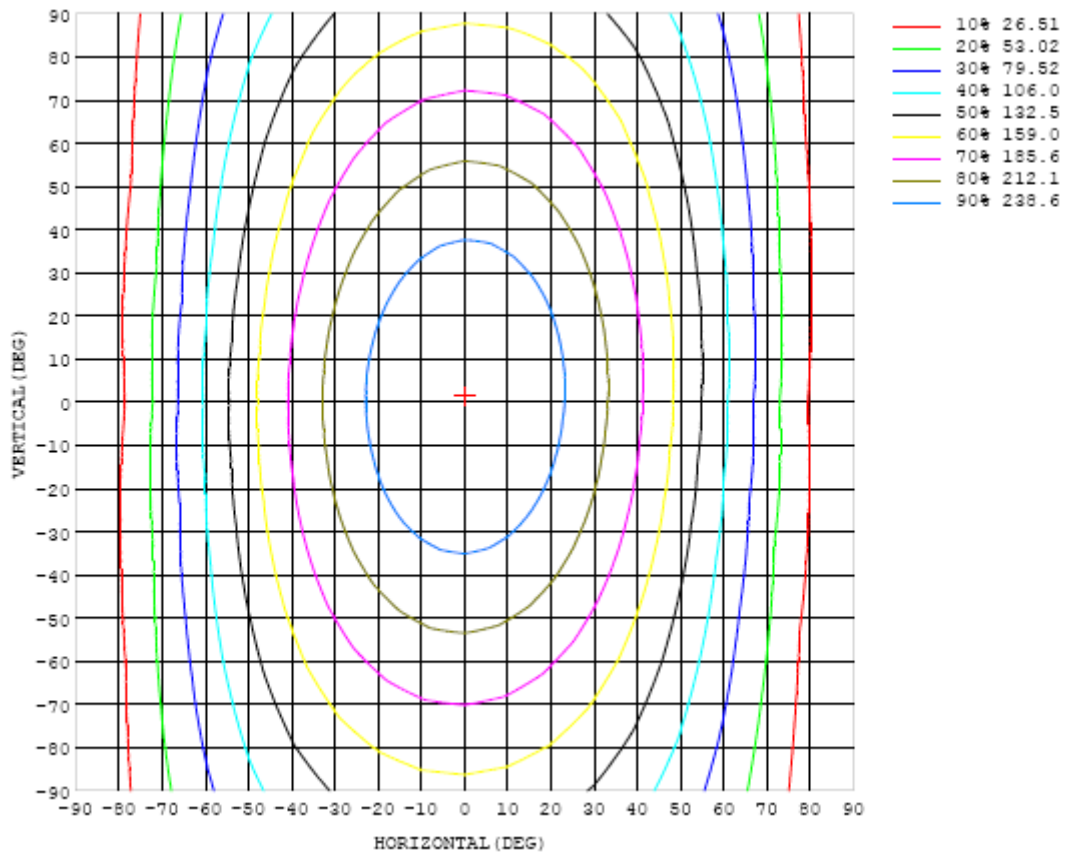


Chart 5: Isocandela Plot

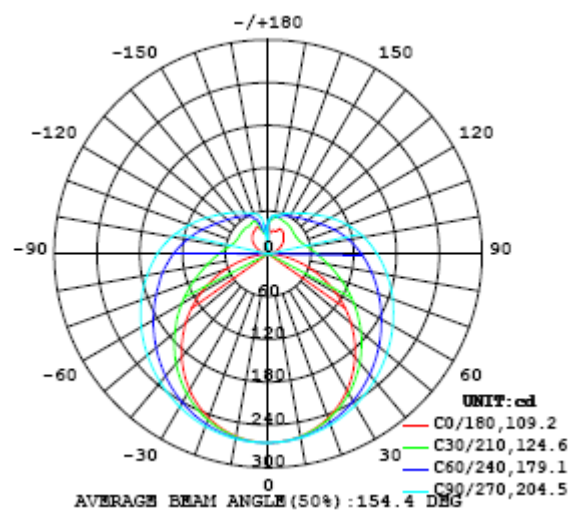


Chart 6: Polar Candela Distribution

## Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

C (DEG) γ (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	265	265	265	265	265	265	265	265	265	265	265	265	265	265	265	265	265	265	265
5	264	264	264	264	264	264	264	264	264	264	264	264	264	264	264	264	264	264	264
10	260	260	260	260	261	261	261	262	262	262	262	262	261	261	261	260	260	260	260
15	254	254	254	255	256	257	257	258	259	259	259	258	258	257	256	255	254	254	253
20	245	245	246	247	249	250	252	254	255	255	255	254	253	251	249	247	246	245	245
25	234	234	235	237	240	243	246	248	250	250	250	249	247	244	241	238	235	234	234
30	221	221	223	226	230	234	238	242	244	245	244	243	240	236	231	227	223	221	221
35	206	206	209	214	219	225	230	235	237	239	238	236	232	226	221	215	210	207	205
40	190	190	194	200	207	215	221	227	230	232	231	228	223	217	209	201	195	190	189
45	171	172	177	185	194	204	212	219	223	225	224	220	214	206	197	187	178	172	170
50	152	153	160	170	181	193	203	210	215	217	216	212	205	196	184	172	161	154	151
55	131	133	142	154	168	182	193	202	208	210	209	204	196	185	172	157	144	134	130
60	110	112	123	139	155	171	184	193	199	202	201	195	187	174	159	142	126	113	108
65	87.6	91.5	105	124	143	160	174	185	191	194	192	187	177	164	147	128	108	92.2	85.7
70	65.6	70.8	88.0	110	131	150	165	176	183	186	184	178	168	154	136	115	91.8	71.9	63.1
75	44.2	51.6	72.1	96.8	120	140	156	167	175	178	176	170	160	145	125	102	76.8	53.4	41.2
80	24.3	34.0	58.9	85.5	110	131	147	159	166	169	168	162	151	136	116	91.5	64.3	37.2	22.2
85	8.53	20.5	47.9	75.9	101	122	139	151	158	161	160	153	143	127	107	82.4	54.5	25.3	6.48
90	0.88	13.0	40.3	68.4	93.1	114	131	143	150	153	151	145	134	119	99.1	74.8	47.3	18.9	0.55
95	1.53	10.2	35.1	62.1	86.0	107	123	134	142	145	143	137	127	112	92.1	69.2	42.3	16.0	1.76
100	4.21	10.8	31.5	56.4	79.2	99.1	115	126	133	136	135	129	119	104	85.3	63.4	38.5	16.3	4.41
105	7.77	13.3	30.0	51.8	72.9	91.8	107	118	125	127	126	120	111	96.8	78.9	58.5	36.5	18.1	7.95
110	11.7	17.0	30.1	48.6	67.8	84.7	98.8	109	116	118	117	112	103	89.7	73.1	54.7	36.4	21.2	12.1
115	16.0	20.9	31.2	46.8	63.2	78.4	91.3	101	107	110	108	104	94.9	82.9	68.5	52.7	37.3	24.9	16.3
120	20.3	25.0	33.2	46.0	59.9	72.7	84.3	93.1	98.7	101	99.9	95.5	87.7	76.9	64.8	51.6	38.7	28.6	20.8
125	24.3	29.0	35.8	45.8	57.7	68.9	78.1	85.7	90.8	92.9	92.0	87.9	81.1	72.3	62.2	51.0	40.4	32.0	24.9
130	28.2	32.9	38.6	46.4	56.1	65.5	73.3	79.7	83.8	85.6	84.8	81.5	76.0	69.1	60.3	50.9	42.3	35.2	28.7
135	30.4	35.1	41.4	47.4	55.0	62.9	69.7	74.5	78.1	79.6	79.0	76.3	71.5	66.0	58.7	51.3	43.3	37.9	31.7
140	33.6	38.4	44.0	48.6	54.5	60.7	66.2	70.3	73.0	74.3	73.8	71.5	68.2	63.4	57.6	51.8	43.4	39.3	34.2
145	36.8	41.8	45.8	49.6	54.3	59.1	63.4	66.9	69.1	69.8	69.6	68.0	65.1	61.2	56.7	51.2	46.7	43.7	36.4
150	38.0	44.1	47.7	50.2	54.1	57.7	60.9	63.6	65.3	66.2	65.9	64.5	62.3	59.4	56.2	50.5	46.1	45.5	37.5
155	38.5	44.9	49.1	50.4	53.0	56.5	59.0	60.8	62.1	62.7	62.5	61.5	59.9	58.0	54.6	51.0	50.4	46.5	40.3
160	33.5	46.3	50.9	52.1	52.4	54.2	56.5	58.4	59.5	59.8	59.7	59.1	58.1	56.2	54.0	53.0	49.1	47.2	39.4
165	33.4	43.7	50.7	52.7	53.4	54.6	54.1	53.6	54.6	55.8	56.1	55.8	55.5	55.2	53.8	52.3	47.3	40.8	34.8
170	31.8	42.4	48.5	51.2	53.2	53.8	54.1	54.3	54.5	54.8	54.9	54.8	54.6	54.3	52.4	46.1	37.8	34.6	31.7
175	32.7	36.8	43.6	48.0	49.3	50.4	51.2	51.8	52.2	52.4	52.4	52.1	51.6	48.4	40.7	32.8	28.9	27.7	27.4
180	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9

Table 6: Luminous Intensity Data

Table--2

UNIT: cd

C (DEG) y (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	265	265	265	265	265	265	265	265	265	265	265	265	265	265	265	265	265		
5	264	264	264	264	264	264	265	265	265	265	265	265	264	264	264	264	264		
10	260	260	261	261	262	263	263	263	263	263	263	263	262	262	261	261	260		
15	254	254	256	257	258	259	260	261	261	261	260	260	259	257	256	255	254		
20	245	246	248	250	252	254	256	257	258	257	257	255	253	251	249	247	246		
25	234	236	239	242	245	248	251	252	253	253	252	249	247	243	240	237	235		
30	221	224	227	232	236	241	244	247	248	248	246	243	239	234	229	226	223		
35	207	210	215	221	227	233	237	241	242	241	239	235	230	224	217	212	208		
40	190	194	201	209	217	224	230	234	235	235	232	227	220	212	204	197	192		
45	172	178	186	196	206	215	222	226	228	228	224	218	210	200	190	181	175		
50	153	160	171	183	195	205	213	219	221	220	216	209	199	187	175	164	157		
55	133	143	156	170	184	196	205	211	213	212	208	199	188	175	161	147	137		
60	112	124	140	157	173	186	196	203	206	204	199	190	178	162	146	130	117		
65	90.6	106	125	145	162	177	188	195	197	196	191	181	167	151	132	112	95.9		
70	69.5	88.0	111	133	152	167	179	186	189	188	182	172	158	139	118	95.2	75.6		
75	49.6	72.1	97.8	122	143	158	170	178	181	179	173	163	148	129	105	79.7	56.4		
80	32.3	58.5	86.5	112	133	150	162	169	172	171	165	155	139	119	94.0	66.3	39.5		
85	19.6	47.9	77.0	103	124	141	154	161	164	162	157	146	130	109	84.3	55.5	26.4		
90	13.1	40.5	69.1	94.6	116	133	145	153	156	154	148	137	121	101	76.1	47.6	18.8		
95	10.6	35.1	62.1	86.8	108	124	136	144	147	145	139	128	113	92.8	68.7	41.3	14.9		
100	11.5	31.8	56.3	79.6	99.6	115	127	134	137	136	130	119	104	85.2	62.2	36.8	14.4		
105	13.9	31.0	52.0	73.3	92.0	107	118	125	128	126	120	110	96.3	78.2	56.9	34.6	16.0		
110	17.8	31.7	49.4	67.9	85.0	98.9	109	116	118	117	112	102	88.8	72.0	53.0	34.0	19.0		
115	21.5	33.2	48.2	64.0	78.7	91.3	101	107	109	108	103	94.1	81.9	67.1	50.6	34.6	22.7		
120	24.9	35.2	47.7	61.2	74.0	84.7	93.0	98.5	101	99.3	94.7	86.8	76.3	63.4	49.3	36.2	26.5		
125	27.7	37.2	47.9	59.2	70.1	79.4	86.6	91.2	92.9	91.8	87.8	81.0	71.9	60.8	48.9	38.5	29.9		
130	30.7	39.2	48.1	57.8	66.9	74.8	81.0	84.9	86.4	85.4	81.9	76.1	68.2	58.8	49.1	40.5	32.4		
135	33.4	40.4	48.1	56.7	64.2	70.8	76.0	79.3	80.5	79.6	76.7	71.8	65.2	57.6	49.4	42.1	34.9		
140	34.8	42.5	48.1	55.8	61.8	67.2	71.5	74.3	75.3	74.6	72.1	68.1	62.7	56.6	49.8	44.1	37.5		
145	35.2	44.5	47.1	52.6	60.2	64.2	67.6	69.8	70.7	70.1	68.2	64.9	60.8	55.2	49.8	46.2	39.4		
150	34.9	46.4	48.5	51.8	56.7	61.5	64.1	65.9	66.5	66.2	64.8	62.3	58.4	54.1	50.7	47.3	39.4		
155	33.5	46.9	50.1	51.0	52.2	57.9	61.0	62.4	63.0	62.6	61.2	58.8	56.2	53.9	51.9	48.2	38.5		
160	32.7	37.7	45.3	48.2	51.9	52.5	57.5	59.5	60.0	59.1	57.8	56.7	55.4	54.2	52.3	43.6	34.2		
165	30.9	31.6	34.5	37.5	39.6	41.5	46.5	52.2	57.3	56.5	56.1	55.7	55.2	53.0	43.8	34.9	29.7		
170	28.2	28.2	28.8	28.7	30.3	31.5	31.5	31.3	50.5	53.0	52.9	45.9	37.0	31.0	30.5	29.8	28.3		
175	28.7	30.6	31.3	34.6	37.7	40.0	41.7	40.0	16.3	35.7	39.8	40.3	38.6	36.0	32.8	28.6	29.4		
180	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9		

Table 7: Luminous Intensity Data

## EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 14, 2018	Aug. 13, 2019
Digital Power Meter	PF2010A	HZTE028-01	Sep. 12, 2018	Sep. 11, 2019
AC Power Supply	DPS1060	HZTE001-06	Aug. 09, 2018	Aug. 08, 2019
DC Power Supply	WY12010	HZTE004-03	Aug. 09, 2018	Aug. 08, 2019
Temperature recorder	JM624U	HZTE018-08	Aug. 09, 2018	Aug. 08, 2019
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 09, 2018	Aug. 08, 2019
Standard source	D908	HZTE012-01	Aug. 14, 2018	Aug. 13, 2019
Integrate Sphere system	3M	HZTE015-04	Aug. 16, 2018	Aug. 15, 2019
Digital Power Meter	WT210	HZTE008-01	Aug. 02, 2018	Aug. 01, 2019
AC Power Supply	PCR 500L	HZTE001-07	Aug. 09, 2018	Aug. 08, 2019
DC Power Supply	IT6154	HZTE004-04	Aug. 09, 2018	Aug. 08, 2019
Standard source	SCL-1400	HZTE012-02	Aug. 16, 2018	Aug. 15, 2019
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 09, 2018	Aug. 08, 2019
Temperature Meter	TES1310	HZTE017-01	Aug. 09, 2018	Aug. 08, 2019

Table 8: Test Equipment List

## TEST METHODS

### Seasoning of SSL Product

For the purpose of rating new SSL products, SSL products shall be tested with no seasoning. Therefore, no seasoning was performed.

### Sphere-Spectroradiometer Method- Photometric and Electrical Measurements

A Labsphere Model CDS 2100 Spectroradiometer and Two Meter Sphere was used to measure correlated color temperature, chromaticity coordinates, and the color rendering index for each SSL unit. The coating reflectance of each sphere is 98%. The measure geometry is  $4\pi$ . Self-absorption correction is conducted in testing. Bandwidth of spectroradiometer is 350nm-1050nm.

Ambient temperature was measured at a position inside the sphere. Each SSL unit was operated on the client provided driver at the rated input voltage in its designated orientation.

The stabilization time typically ranges from 30 min (small integrated LED lamps) to 2 or more hours for large SSL luminaires). It can be judged that stability is reached when the variation (maximum – minimum) of at least 3 readings of the light output and electrical power over a period of 30 min, taken 15 minutes apart, is less than 0.5 %.

Electrical measurements including voltage, current, and power were measured using the Yokogawa Power Analyzer.

The standard reference of the integrated sphere system is halogen incandescent lamp, the intensity distribution type is omni-directional, and is traceable to the National Institute of Standards and Technology.

The uncertainty of integrating sphere system reported in this document is expanded uncertainty is 2.1% with a coverage factor  $k=2$ .

## **Goniophotometer Method**

### **Photometric and Electrical Measurements**

An EVERFINE Type C Model GO-R5000 Goniophotometer was used to measure the intensity at each angle of distribution for each sample. The photometric distance is 2.475m for near-field measurement or 30m for far-field measurement. Bandwidth of spectroradiometer is 380nm-780nm.

Ambient temperature was measured at the same height of the sample mounted on the Goniophotometer equipment. Each SSL unit was operated on the client provided driver at the rated input voltage in its designated orientation.

The stabilization time typically ranges from 30 min (small integrated LED lamps) to 2 or more hours for large SSL luminaires). It can be judged that stability is reached when the variation (maximum – minimum) of at least 3 readings of the light output and electrical power over a period of 30 min, taken 15 minutes apart, is less than 0.5 %.

Electrical measurements including voltage, current, and power were measured using the Everfine Digital Power Meter.

Some graphics were created with Photometric Plus software.

The standard reference of the Goniophotometer system is halogen incandescent lamp, the intensity distribution type is omni-directional, and is traceable to the National Institute of Metrology P.R. China.

The uncertainty of goniophotometer system reported in this document is expanded uncertainty is 2.3% with a coverage factor  $k=2$ .

### **Color Characteristics Measurements**

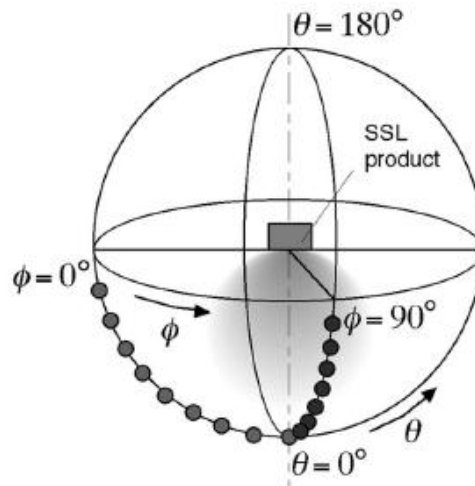
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as values that are spatially average, weighted to intensity, over the angular range where light is intentionally emitted from the SSL product. The color characteristics measurements are using gonio-spectroradiometer.

### **Color Spatial Uniformity**

The characteristics of SSL products may be spatially non-uniform, the chromaticity coordinate shall be measured at two vertical planes ( $C=0^\circ/180^\circ$  and  $C=90^\circ/270^\circ$ ) and at  $10^\circ$  or less intervals for vertical angle until the light output dropped to below 10% of the peak intensity. The averaged weighted chromaticity coordinate

was calculated from these points. The data was then analyzed to check for delta color differences of the  $u'$ ,  $v'$  chromaticity coordinates. The spatial non-uniformity of chromaticity,  $\Delta u'v'$ , is determined as the maximum deviation (distance on the CIE ( $u'$ ,  $v'$ ) diagram) among all measured points from the spatially averaged chromaticity coordinate.

The geometry for the chromaticity measurement using gonio-spectroradiometer is shown as following.



\*\*\* End of Report \*\*\*

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