



## LM-79-08 Test Report

for

### GREEN CREATIVE LTD

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

### FG40 LAMP

Model: 5FG40DIM/827

### Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

3rd Floor, Bld. 2, NO. 96 Longchuanwu Rd Qianjiang Economy Dev. Zone, Yuhang Dist,  
Hangzhou, Zhejiang Province, China 311100

Tel: +86 571 86376106

www.ledtestlab.com

Report No.: HZ17060018e

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

Review by:

Engineer: April Zou  
Jun. 16, 2017

Approved by:



Manager: Jim Zhang  
Jun. 16, 2017

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: **5FG40DIM/827**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
107.7	486.8	4.52	0.8945
CCT (K)	CRI	Stabilization Time (Light & Power)	
2732	82.9	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** : Jun. 12, 2017

**Date of Test** : Jun. 15, 2017

**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

## TABLE OF CONTENT

LM-79-08 Test Report.....	1
Test Summary.....	2
Sample Photos.....	4
TEST RESULTS.....	5
Goniophotometer Method.....	6
Spectral Power Distribution - Sphere Spectroradiometer Method.....	7
Chromaticity Diagram - Sphere Spectroradiometer Method.....	8
Nominal CCT Quadrangles – Sphere Spectroradiometer Method.....	9
Zonal Lumen Tabulation- Goniophotometer Method.....	10
Luminous Intensity Distribution Plots- Goniophotometer Method.....	12
Luminous Intensity Data- Goniophotometer Method.....	13
EQUIPMENT LIST.....	15
TEST METHODS.....	15
Seasoning of SSL Product.....	15
Sphere-Spectroradiometer Method- Photometric and Electrical Measurements.....	15
Goniophotometer Method.....	16
Photometric and Electrical Measurements.....	16
Color Characteristics Measurements.....	16
Color Spatial Uniformity.....	16

## Sample Photos



Figure 1- Overview of the sample

### Equipment Under Test (EUT)

<b>Name</b>	: FG40 Lamp
<b>Model</b>	: 5FG40DIM/827
<b>Electrical Ratings</b>	: 120V, 60Hz, 5W
<b>Product Description</b>	: E26 base, 2700K, CRI80
<b>Manufacturer</b>	: GREEN CREATIVE LTD
<b>Address</b>	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

## TEST RESULTS

Test ambient temperature was 25.0°C.

Base orientation was base up. 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
Voltage frequency (Hz)	60
Test Current (A)	0.042
Power Factor	0.8945
Test Power (W)	4.52
THD A%	39.8
Luminous Efficacy (lm/W)	107.7
Total Luminous Flux (lm)	486.8
Color Rendering Index (CRI)	82.9
R9	9.4
Correlated Color Temperature (CCT)(K)	2732
Chromaticity Chroma x	0.4573
Chromaticity Chroma y	0.4103
Chromaticity Chroma u	0.2610
Chromaticity Chroma v	0.3512
Duv	0.0001
Chromaticity Chroma u'	0.2610
Chromaticity Chroma v'	0.5268

Special Color Rendering Indices	
R1	82.1
R2	93.4
R3	93.4
R4	80.1
R5	82.6
R6	93.3
R7	80.8
R8	57.5
R9	9.4
R10	85.5
R11	80.2
R12	77
R13	85
R14	97.1
Rf	84
Rg	94

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 25.1°C.

The photometric distance is 2.47m.

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)	0.042
Power Factor	0.8876
Test Power (W)	4.50
Luminous Efficacy (lm/W)	109.6
Total Luminous Flux (lm)	493.3
Beam Angle (°)	322.7
Center Beam Candle Power (cd)	15.8
Spacing Criteria	2.87 (0°-180°)/ 2.93 (90°-270°)
Zonal Lumens in the 0°-60°Zone	22.43%
Zonal Lumens in the 60°-90°Zone	31.42%
Zonal Lumens in the 90°-120°Zone	29.81%
Zonal Lumens in the 120°-180°Zone	16.34%

Table 3: Test data per Goniophotometer Method

### Spectral Power Distribution - Sphere Spectroradiometer Method

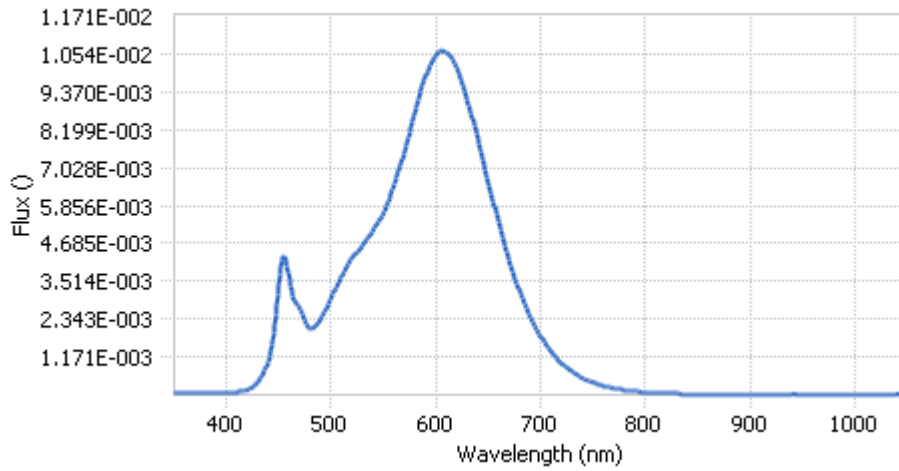
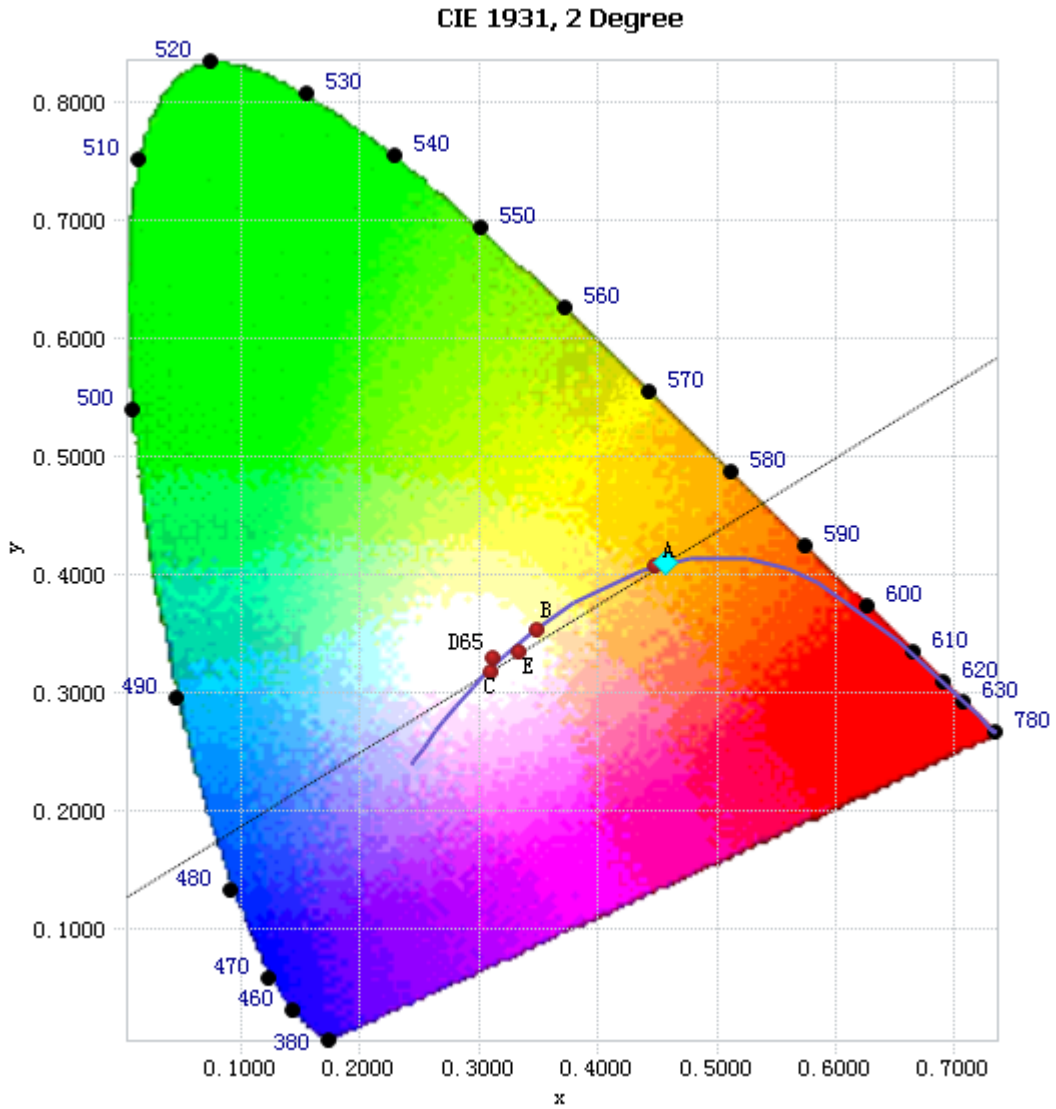


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	5.59E-05	485	2.17E-03	590	9.85E-03	695	2.12E-03
385	5.54E-05	490	2.36E-03	595	1.03E-02	700	1.81E-03
390	5.74E-05	495	2.65E-03	600	1.05E-02	705	1.56E-03
395	6.36E-05	500	3.00E-03	605	1.06E-02	710	1.34E-03
400	7.03E-05	505	3.36E-03	610	1.06E-02	715	1.15E-03
405	6.68E-05	510	3.68E-03	615	1.04E-02	720	9.85E-04
410	9.19E-05	515	3.99E-03	620	1.01E-02	725	8.48E-04
415	1.17E-04	520	4.22E-03	625	9.66E-03	730	7.22E-04
420	1.58E-04	525	4.42E-03	630	9.13E-03	735	6.09E-04
425	2.49E-04	530	4.64E-03	635	8.56E-03	740	5.21E-04
430	3.99E-04	535	4.84E-03	640	7.93E-03	745	4.44E-04
435	6.51E-04	540	5.09E-03	645	7.23E-03	750	3.82E-04
440	1.08E-03	545	5.35E-03	650	6.60E-03	755	3.23E-04
445	1.94E-03	550	5.65E-03	655	5.92E-03	760	2.79E-04
450	3.40E-03	555	6.04E-03	660	5.31E-03	765	2.37E-04
455	4.28E-03	560	6.48E-03	665	4.72E-03	770	2.01E-04
460	3.55E-03	565	7.00E-03	670	4.16E-03	775	1.72E-04
465	2.91E-03	570	7.55E-03	675	3.66E-03	780	1.47E-04
470	2.64E-03	575	8.15E-03	680	3.21E-03		
475	2.29E-03	580	8.74E-03	685	2.79E-03		
480	2.06E-03	585	9.36E-03	690	2.43E-03		

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

### Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4573, 0.4103)

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**

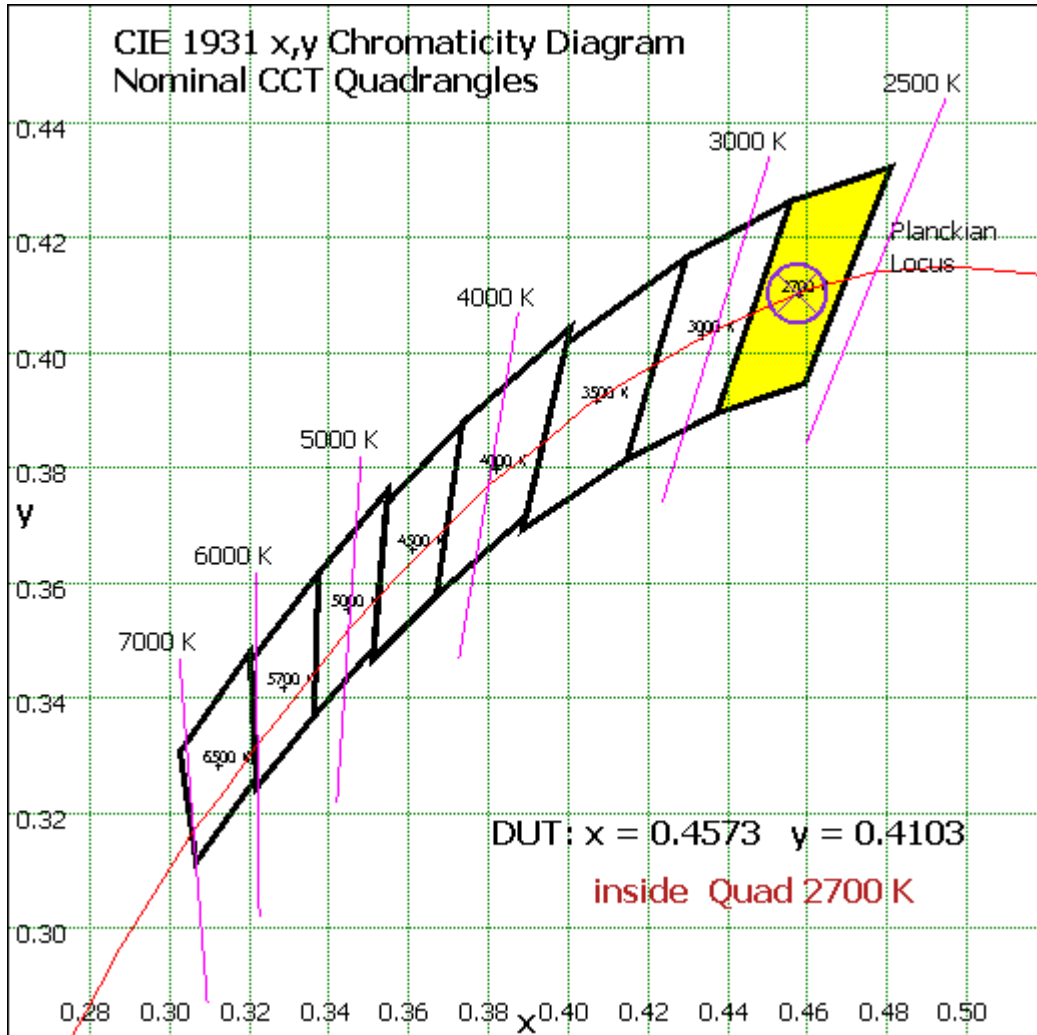


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

### Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	1.568	0.32%
10- 20	5.675	1.15%
20- 30	12.224	2.48%
30- 40	20.959	4.25%
40- 50	30.478	6.18%
50- 60	39.754	8.06%
60- 70	47.589	9.65%
70- 80	52.668	10.68%
80- 90	54.706	11.09%
90-100	54.024	10.95%
100-110	50.074	10.15%
110-120	42.928	8.70%
120-130	33.611	6.81%
130-140	23.777	4.82%
140-150	14.754	2.99%
150-160	7.085	1.44%
160-170	1.362	0.28%
170-180	0.022	0.00%
Total	493.3	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	110.658	22.43%
60- 90	154.963	31.42%
0-90	265.621	53.85%
90- 180	227.637	46.15%
0- 180	493.3	100%

Table 5: Zonal Lumen Data

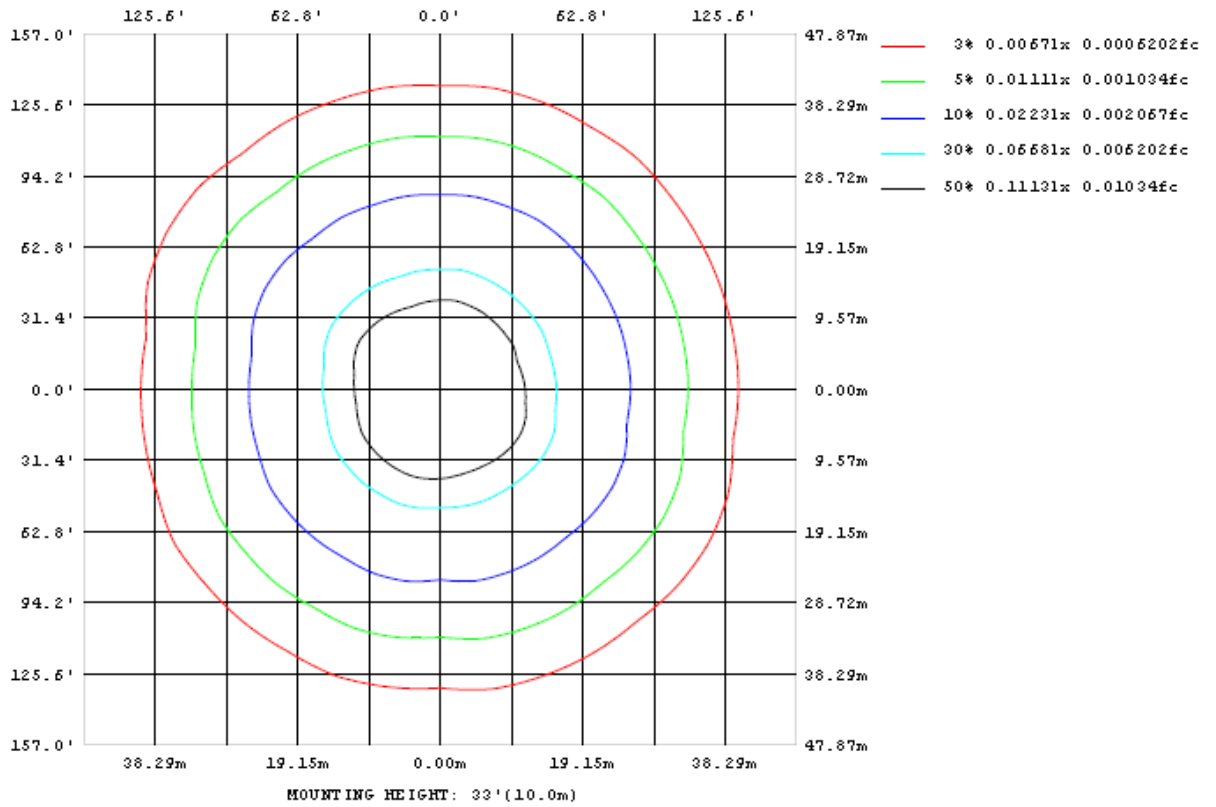


Chart 4: Illuminance Plot (Footcandles)

### Luminous Intensity Distribution Plots- Goniophotometer Method

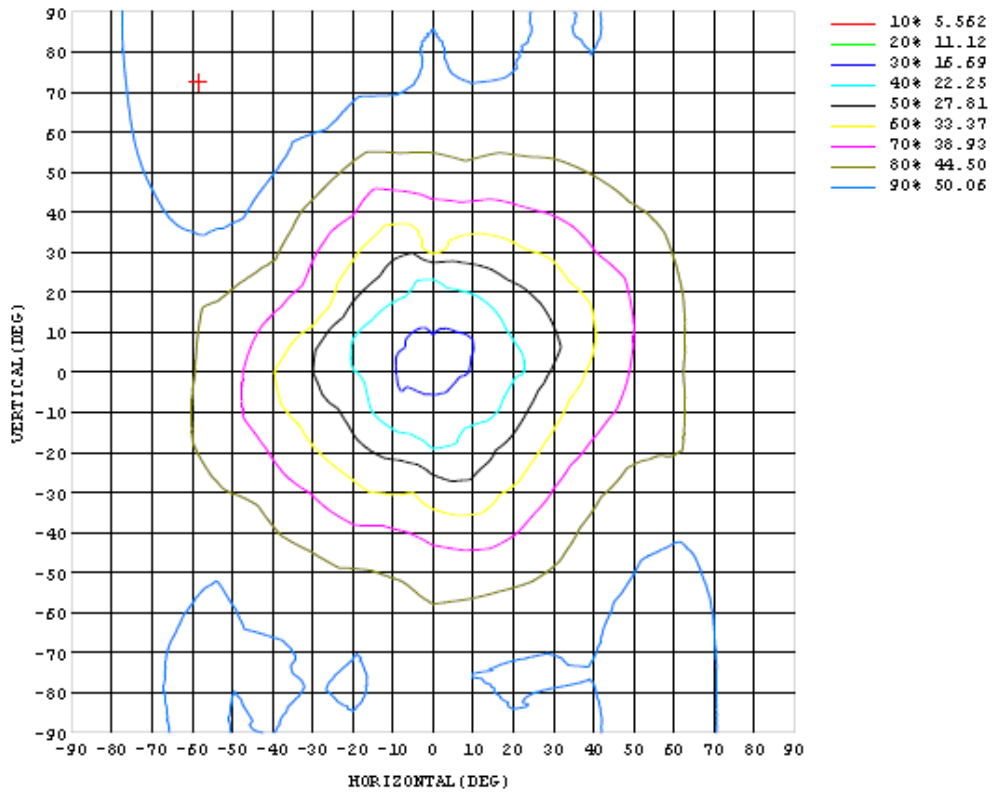


Chart 5: Isocandela Plot

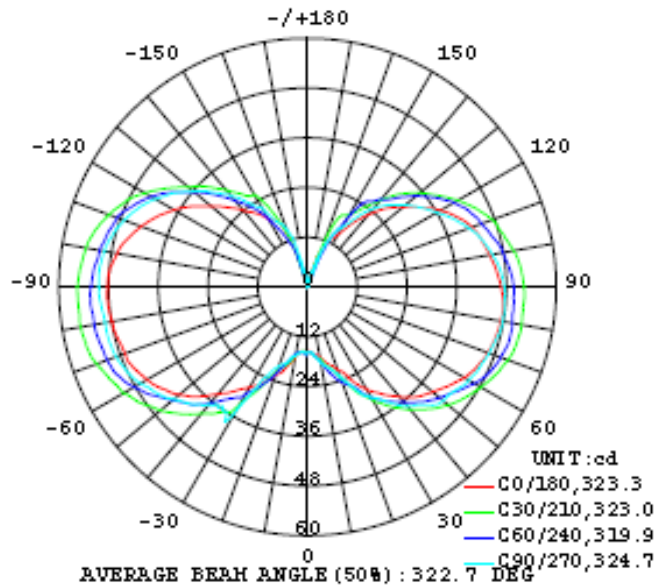


Chart 6: Polar Candela Distribution

**Luminous Intensity Data- Goniophotometer Method**

Table--1 UNIT: cd

C (DEG) 7 (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8
5	16.5	16.4	16.4	16.4	16.3	16.3	16.4	16.5	16.4	16.4	16.5	16.3	16.5	16.3	16.3	16.2	16.2	15.9	15.7
10	17.2	17.5	17.8	17.6	17.9	18.1	18.4	18.5	18.5	18.6	18.6	18.5	18.6	18.2	17.1	17.1	17.1	17.2	17.1
15	19.3	19.9	20.0	20.2	20.1	21.0	21.6	21.4	20.4	20.3	20.5	20.9	20.8	20.4	20.5	20.2	20.5	20.4	20.1
20	21.5	22.6	23.4	23.2	23.7	24.8	24.5	23.1	23.2	23.1	24.2	25.0	24.2	24.0	23.9	23.9	24.4	23.8	22.4
25	24.8	26.6	27.5	27.8	27.8	28.0	26.6	26.4	25.9	27.1	30.0	29.1	28.2	27.9	27.7	28.0	27.6	26.0	25.3
30	28.5	30.8	31.3	31.5	31.3	31.2	30.8	28.8	29.5	30.7	33.1	31.9	31.3	31.6	31.1	30.9	30.3	28.9	27.8
35	31.5	33.6	34.4	35.3	35.0	33.8	33.6	31.9	32.6	33.9	36.1	35.5	34.4	34.6	34.3	33.6	33.1	31.5	30.7
40	34.6	36.1	37.5	38.7	38.5	37.4	36.3	35.5	36.2	37.5	38.8	38.9	37.5	37.6	37.6	36.2	36.2	34.2	33.7
45	37.4	38.6	40.5	41.6	41.3	40.5	39.2	38.4	39.0	40.2	41.2	41.7	40.7	40.9	41.0	39.6	38.9	37.3	37.3
50	39.4	40.4	43.3	44.3	43.8	42.7	41.5	41.2	41.6	42.7	43.5	44.1	43.6	43.3	43.1	42.9	41.2	39.7	40.4
55	41.6	42.1	45.7	46.5	46.2	44.7	43.9	43.6	43.6	43.5	45.4	46.1	45.2	45.7	45.1	45.7	43.4	42.0	42.8
60	43.7	43.4	47.5	48.4	47.8	46.7	46.5	46.3	45.8	45.0	46.7	47.7	46.9	47.4	47.0	47.1	45.3	43.9	44.7
65	45.2	44.8	49.2	50.1	49.2	48.0	48.5	48.4	48.0	45.8	48.4	49.1	47.8	48.5	49.1	48.4	46.8	45.9	46.3
70	46.4	45.8	50.2	51.5	50.5	49.0	49.6	49.5	49.3	46.6	49.3	49.9	48.8	49.3	49.8	50.3	47.9	47.5	46.9
75	47.0	46.5	50.9	52.2	51.4	49.6	50.3	50.2	49.9	47.3	49.1	50.3	49.5	50.5	50.4	51.2	48.5	48.0	47.5
80	47.4	46.5	51.1	52.5	52.2	50.0	50.1	50.2	49.9	47.8	49.1	50.5	49.9	50.5	50.2	51.6	49.3	48.3	47.9
85	47.4	46.3	50.6	52.2	52.7	49.6	49.9	50.0	49.4	47.6	48.9	50.0	49.5	50.3	50.0	51.6	49.5	48.6	48.3
90	46.7	46.2	50.3	52.3	52.8	49.4	49.8	49.4	48.8	47.5	48.4	49.2	49.2	50.1	50.0	51.3	49.1	48.4	48.3
95	45.7	45.9	49.6	51.6	52.2	49.0	49.0	48.5	48.2	46.7	47.7	48.6	48.7	49.4	49.9	50.2	48.6	47.9	47.9
100	44.7	45.5	48.5	50.5	51.2	48.4	47.8	47.3	46.9	45.3	47.9	47.8	47.6	48.0	49.0	49.1	47.5	46.9	46.6
105	43.5	44.5	47.0	48.9	49.3	46.9	46.3	45.3	45.2	43.7	46.4	45.6	46.1	46.5	47.7	47.7	45.7	45.6	45.0
110	42.2	42.5	45.0	47.4	47.8	45.2	44.7	43.6	43.0	41.5	43.9	43.1	44.1	44.6	45.9	45.9	43.9	43.6	42.7
115	39.9	39.9	43.0	44.9	45.5	43.1	43.1	41.6	40.2	38.9	41.9	40.2	41.5	41.8	43.4	43.1	41.7	41.1	40.1
120	37.0	37.5	40.5	41.8	42.6	40.3	40.8	39.4	37.4	36.0	39.4	37.3	39.1	39.2	41.3	40.2	39.0	38.6	37.2
125	33.5	34.5	37.9	38.5	39.3	38.0	37.6	36.5	34.1	33.4	36.3	34.3	36.2	36.5	38.7	37.3	35.9	35.4	34.0
130	30.0	31.6	35.2	35.4	35.9	35.3	34.3	32.5	30.5	30.8	33.3	31.4	32.8	33.1	35.0	33.7	32.1	31.5	30.4
135	26.9	28.6	31.6	31.7	32.4	31.9	30.4	28.7	27.2	28.0	30.0	28.5	29.5	30.1	31.3	30.4	29.8	27.2	27.1
140	22.8	24.8	27.4	27.3	28.0	28.4	27.7	25.9	23.6	24.7	26.0	25.3	25.9	27.5	28.5	27.7	27.2	23.1	24.2
145	18.9	20.6	23.1	23.3	23.7	26.4	25.3	21.1	19.0	20.3	21.2	21.9	22.4	25.0	27.1	25.7	22.2	19.3	21.7
150	14.5	16.4	18.5	20.1	22.0	22.2	18.8	15.9	15.2	16.5	16.5	17.5	20.0	23.0	21.4	19.9	16.3	15.5	19.0
155	12.4	13.6	16.3	18.8	18.3	15.2	13.0	11.0	13.1	12.8	14.3	15.8	17.0	15.6	15.2	12.7	11.6	14.0	17.6
160	9.13	10.9	11.8	10.7	8.54	6.48	5.68	6.37	6.69	7.28	9.89	9.73	7.09	6.26	6.19	6.88	8.70	11.0	11.8
165	2.76	2.39	2.09	2.04	2.12	1.89	1.81	2.19	2.38	2.29	1.75	2.28	2.52	2.57	2.90	3.45	3.71	3.24	3.33
170	0.20	0.19	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.15	0.16	0.18	0.20	0.22	0.25	0.33	0.45	0.70	0.98
175	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.11	0.10	0.11	0.11	0.12	0.12	0.13
180	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04

Table 6: Luminous Intensity Data

Table--2 UNIT: cd

C (DEG) 7 (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8		
5	15.7	15.6	15.6	15.7	15.8	15.7	15.7	15.7	15.7	15.6	15.7	15.8	16.0	16.0	16.0	16.3	16.5		
10	16.9	16.7	16.7	16.8	16.6	16.3	16.1	16.2	16.8	16.2	16.0	16.0	16.1	16.2	16.3	16.7	17.1		
15	19.8	19.5	19.3	19.0	18.7	18.7	18.7	18.4	18.7	18.5	18.8	18.1	17.7	18.1	18.5	18.9	19.2		
20	21.6	21.3	21.7	22.3	22.3	22.2	22.2	20.9	20.3	21.3	21.1	20.8	21.0	21.2	21.6	21.4	21.1		
25	24.8	24.8	26.4	26.5	26.4	26.0	25.0	24.4	24.1	25.0	25.0	24.7	24.6	24.6	24.4	23.5	23.4		
30	28.0	30.2	32.9	31.7	30.7	29.8	28.0	27.5	34.6	29.7	28.8	28.4	28.3	27.4	27.0	26.8	26.4		
35	32.6	36.1	37.0	36.2	34.4	32.9	31.9	32.1	35.6	33.9	32.5	32.1	31.9	30.5	29.7	29.5	29.7		
40	36.1	38.4	39.9	38.8	37.4	36.5	34.3	34.8	37.0	37.1	36.0	35.2	34.5	33.4	33.4	32.0	32.4		
45	39.1	41.4	43.3	42.3	41.0	40.0	37.3	38.5	40.0	40.3	38.9	38.4	37.8	36.7	36.5	34.9	35.8		
50	40.9	44.0	46.2	45.1	43.8	42.5	41.1	41.8	42.0	42.7	41.8	41.2	40.1	39.6	39.7	37.8	38.4		
55	43.2	46.8	48.9	47.6	47.0	45.5	43.3	44.4	44.6	45.3	43.9	43.5	42.6	42.2	42.3	40.7	40.9		
60	44.8	48.9	51.2	50.3	49.2	48.3	46.4	46.7	46.6	47.1	46.1	45.0	44.8	44.5	44.1	43.0	43.1		
65	46.0	50.6	52.7	52.2	50.3	50.5	48.5	48.7	48.1	48.5	47.7	47.8	47.4	46.3	45.6	44.9	44.9		
70	46.9	52.0	54.2	53.6	51.1	51.4	50.0	50.2	49.1	49.9	49.1	49.7	48.6	47.3	46.6	46.3	46.1		
75	47.3	53.0	55.2	54.9	51.5	51.9	51.2	51.0	49.6	50.6	50.0	48.8	49.5	48.0	47.4	47.1	46.9		
80	47.9	53.8	55.6	55.4	51.8	52.3	51.8	51.1	49.6	51.2	50.3	49.2	50.0	48.3	47.9	47.2	47.0		
85	48.3	54.1	55.5	55.5	52.0	52.5	51.9	50.9	50.0	51.5	50.5	49.6	50.5	48.2	48.5	47.3	46.7		
90	48.7	54.1	55.6	55.4	52.3	52.2	52.1	51.0	50.4	51.6	50.4	49.6	50.5	48.0	49.0	47.2	46.3		
95	48.5	53.4	55.0	54.9	53.3	51.7	51.9	50.8	50.4	51.1	50.3	49.6	50.7	47.6	48.9	47.2	45.6		
100	48.0	52.8	54.3	54.2	51.7	51.0	50.8	49.7	49.8	50.1	49.4	48.6	49.7	46.9	47.8	46.8	44.8		
105	47.0	51.7	53.0	52.8	51.7	49.9	49.3	48.3	48.7	51.5	48.2	47.7	48.6	45.6	46.4	45.8	43.8		
110	45.7	49.7	51.0	50.9	50.1	48.9	47.0	46.1	47.2	47.6	47.0	46.4	46.9	44.4	44.7	44.4	42.3		
115	44.0	47.2	48.6	48.4	47.8	46.4	44.8	43.5	45.0	45.6	45.1	44.8	44.8	42.6	42.5	42.0	40.5		
120	41.4	43.9	45.3	45.3	45.0	43.6	42.1	40.5	42.4	42.5	42.9	42.5	42.4	40.0	39.7	39.0	38.0		
125	38.2	39.9	41.6	42.2	41.5	39.8	38.3	37.0	39.5	39.5	40.0	39.5	39.3	37.2	36.6	35.6	34.8		
130	34.8	36.2	37.6	38.4	37.1	35.6	33.5	33.4	36.0	36.6	36.6	36.0	36.0	34.5	33.3	32.4	31.5		
135	31.5	32.8	34.2	35.6	33.5	31.5	29.3	30.0	32.2	33.3	33.1	32.5	32.5	31.3	29.9	29.7	28.3		
140	27.9	28.9	30.5	31.8	30.2	27.2	25.5	26.4	28.7	29.3	29.8	29.2	28.7	27.5	26.2	26.4	25.4		
145	24.3	25.4	27.3	28.5	26.8	23.4	21.9	23.0	24.8	25.1	26.1	24.8	21.0	22.2	23.0	23.9	23.1		
150	21.5	23.3	25.8	25.1	21.9	19.2	18.0	19.2	22.1	21.1	22.5	21.0	15.8	12.4	13.8	20.5	17.4		
155	19.9	20.6	19.9	18.0	15.8	14.3	15.5	16.9	17.4	17.8	19.0	17.9	16.4	11.4	8.02	12.4	12.3		
160	11.7	11.8	11.9	10.1	8.14	10.4	13.1	13.8	14.8	15.8	17.3	17.8	14.2	8.05	5.48	5.92	7.76		
165	3.50	3.50	3.98	4.21	4.07	5.19	6.05	7.22	7.91	9.34	9.29	6.23	4.05	2.48	2.26	3.00	2.46		
170	1.28	1.20	1.21	1.13	0.99	1.16	1.53	1.49	1.42	1.40	1.32	1.16	0.84	0.55	0.31	0.24	0.22		
175	0.13	0.16	0.16	0.16	0.16	0.16	0.16	0.15	0.14	0.13	0.11	0.11	0.11	0.11	0.10	0.10	0.10		
180	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04		

Table 7: Luminous Intensity Data

## EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Jul. 26, 2016	Jul. 25, 2017
Digital Power Meter	PF2010A	HZTE028-01	Jul. 26, 2016	Jul. 25, 2017
AC Power Supply	DPS1060	HZTE001-06	Dec. 25, 2016	Dec. 24, 2017
DC Power Supply	WY12010	HZTE004-03	Dec. 25, 2016	Dec. 24, 2017
Temperature Meter	TES1310	HZTE017-01	Aug. 08, 2016	Aug. 07, 2017
Standard source	D908	HZTE012-01	Jul. 28, 2016	Jul. 27, 2017
Integrate Sphere system	2M	HZTE015-01	Jul. 26, 2016	Jul. 25, 2017
Digital Power Meter	WT210	HZTE008-01	Jul. 26, 2016	Jul. 25, 2017
AC Power Supply	PCR 500L	HZTE001-07	Dec. 25, 2016	Dec. 24, 2017
DC Power Supply	IT6154	HZTE004-04	Jul. 27, 2016	Jul. 26, 2017
Temperature and humidity recorder	JR900	HZTE018-01	Dec. 25, 2016	Dec. 24, 2017
Standard source	SCL-1400	HZTE012-02	Jul. 28, 2016	Jul. 27, 2017

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 FA19 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 FA19 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.

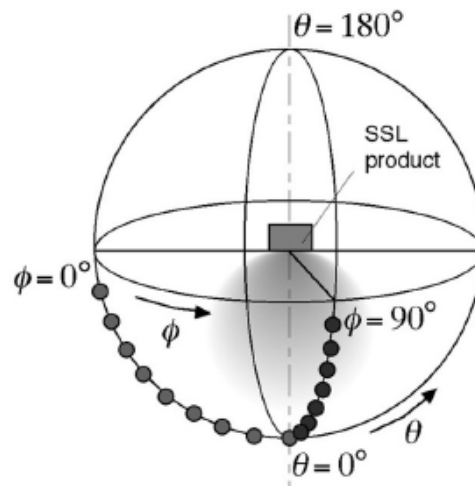
### **Color Spatial Uniformity**

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 \*\*\*

This report is considered invalidated without the Special Seal for Inspection of the LTL. This report shall not be altered, increased or deleted. The results shown in this test report refer only to the sample(s) tested. Without written approval of LTL, this test report shall not be copied except in full and published as advertisement.