

## LM-79-08 TEST REPORT

for

### GREEN CREATIVE LTD

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

### LED Tube

**Model: 6PLV/840/DIR/R**

### Laboratory: Leading Testing Laboratories

**NVLAP CODE: 200960-0**

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Report No.: HZ19060003h

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

Review by:



Engineer: April Zou  
Jun. 10, 2019

Approved by:



Manager: Jim Zhang  
Jun. 10, 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: **6PLV/840/DIR/R**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)/2	Power Factor
102.9	761.0	7.40	0.9966
CCT (K)	CRI	Stabilization Time (Light & Power)	
4000	83.9	60	

Table 1: Executive Data Summary

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

### Test specifications:

<b>Date of Receipt</b>	: Jun. 04, 2019
<b>Date of Test</b>	: Jun. 05, 2019
<b>Test item</b>	: Total Luminous Flux, Luminous Distribution Intensity, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters
<b>Reference Standard</b>	: IESNA LM-79-2008 Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products ANSI/IES TM-30-18 IES Method for Evaluating Light Source Color Rendition

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## SAMPLE PHOTO

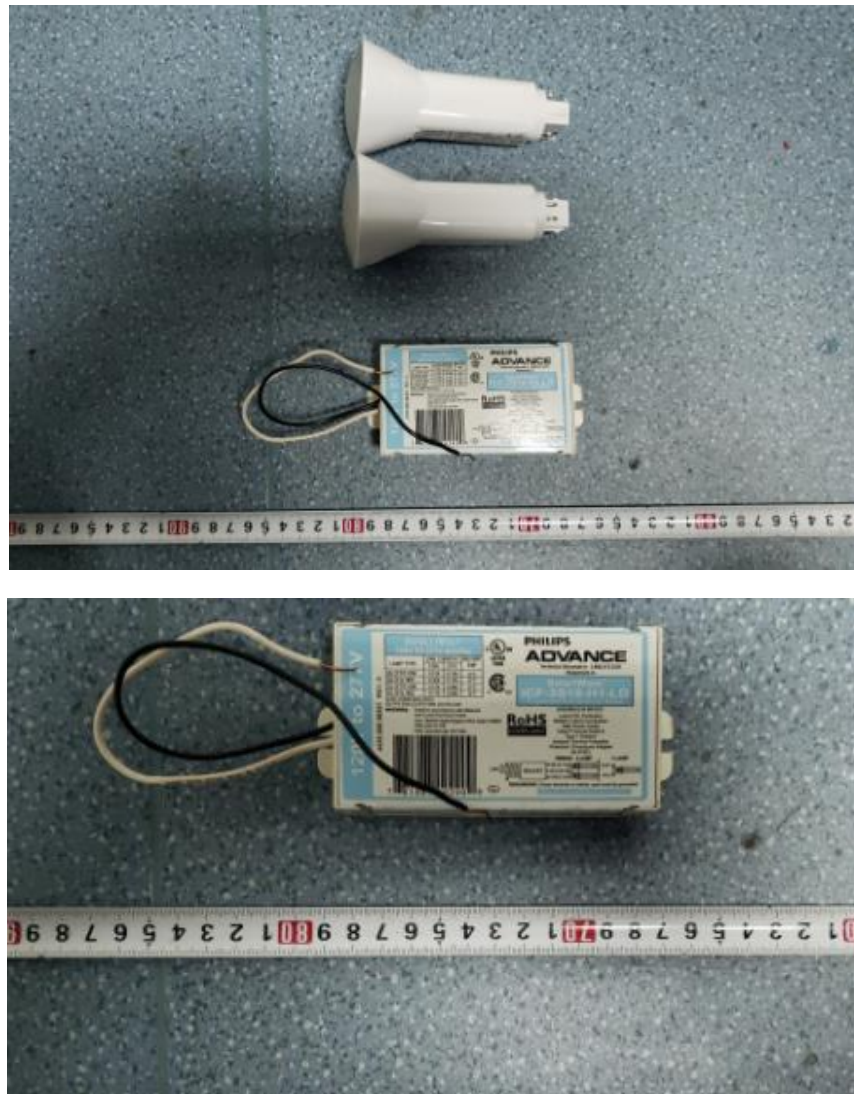


Figure 1- Overview of the sample

### Equipment Under Test(EUT)

<b>Name</b>	: LED Tube
<b>Model</b>	: 6PLV/840/DIR/R
<b>Electrical Ratings</b>	: 120-277V, 60Hz, 6W
<b>Product Description</b>	: 4000K LED Tubes supplied by a high frequency fluorescent lamp ballast: ICF-2S18-H1-LD
<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 light down. 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 65 minutes.

### Sphere-Spectroradiometer Method

Parameter	Result	
Test Voltage (V)	120.0	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.124	0.057
Power Factor	0.9966	0.9636
Test Power (W)/2	7.40	7.61
THD A%	6.45	9.75
Luminous Efficacy (lm/W)	102.9	100.2
Total Luminous Flux (lm)	761.0	762.0
Color Rendering Index (CRI)	83.9	
R9	11.6	
Correlated Color Temperature (CCT)(K)	4000	
Chromaticity Chroma x	0.3803	
Chromaticity Chroma y	0.3766	
Chromaticity Chroma u	0.2251	
Chromaticity Chroma v	0.3343	
Duv	0	
Chromaticity Chroma u'	0.2251	
Chromaticity Chroma v'	0.5015	

Special Color Rendering Indices	
R1	82.5
R2	92.1
R3	95.8
R4	80.6
R5	82.4
R6	88.4
R7	84.9
R8	64.3
R9	11.6
R10	80.6
R11	79.4
R12	65.1
R13	85.3
R14	98.3

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 24.8 °C.

The photometric distance is 2.47 m.

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)	0.124
Power Factor	0.9968
Power (W)/2	7.42
Luminous Efficacy (lm/W)	104.2
Total Luminous Flux (lm)	772.8
Beam Angle (°)	107.1 (0°-180°) / 107.4 (90°-270°)
Center Beam Candle Power (cd)	275
Maximum Beam Candle Power (cd)	275.3 (At: C=70.0, Gamma=0.5)
Spacing Criteria	1.25 (0°-180°) / 1.24 (90°-270°)
Zonal Lumens in the 0°-60° Zone	77.43%
Zonal Lumens in the 60°-90° Zone	21.28%
Zonal Lumens in the 90°-120° Zone	1.21%
Zonal Lumens in the 120°-180° Zone	0.08%

Table 3: Test data per Goniophotometer Method

## Spectral Power Distribution - Sphere Spectroradiometer Method

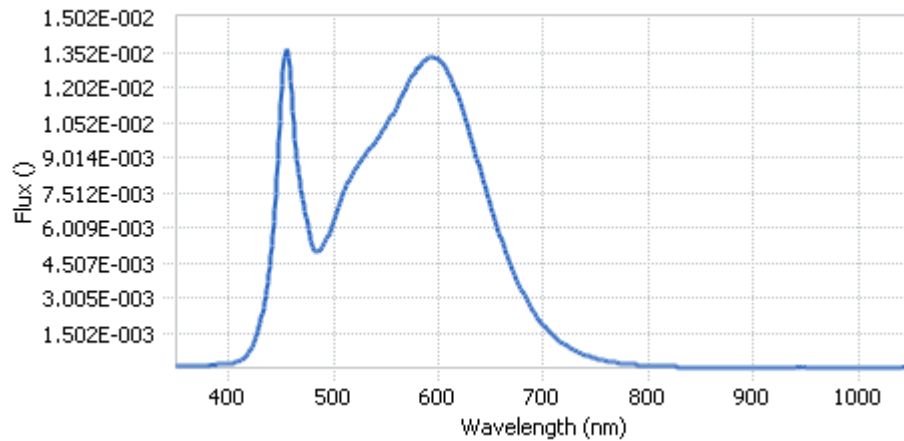


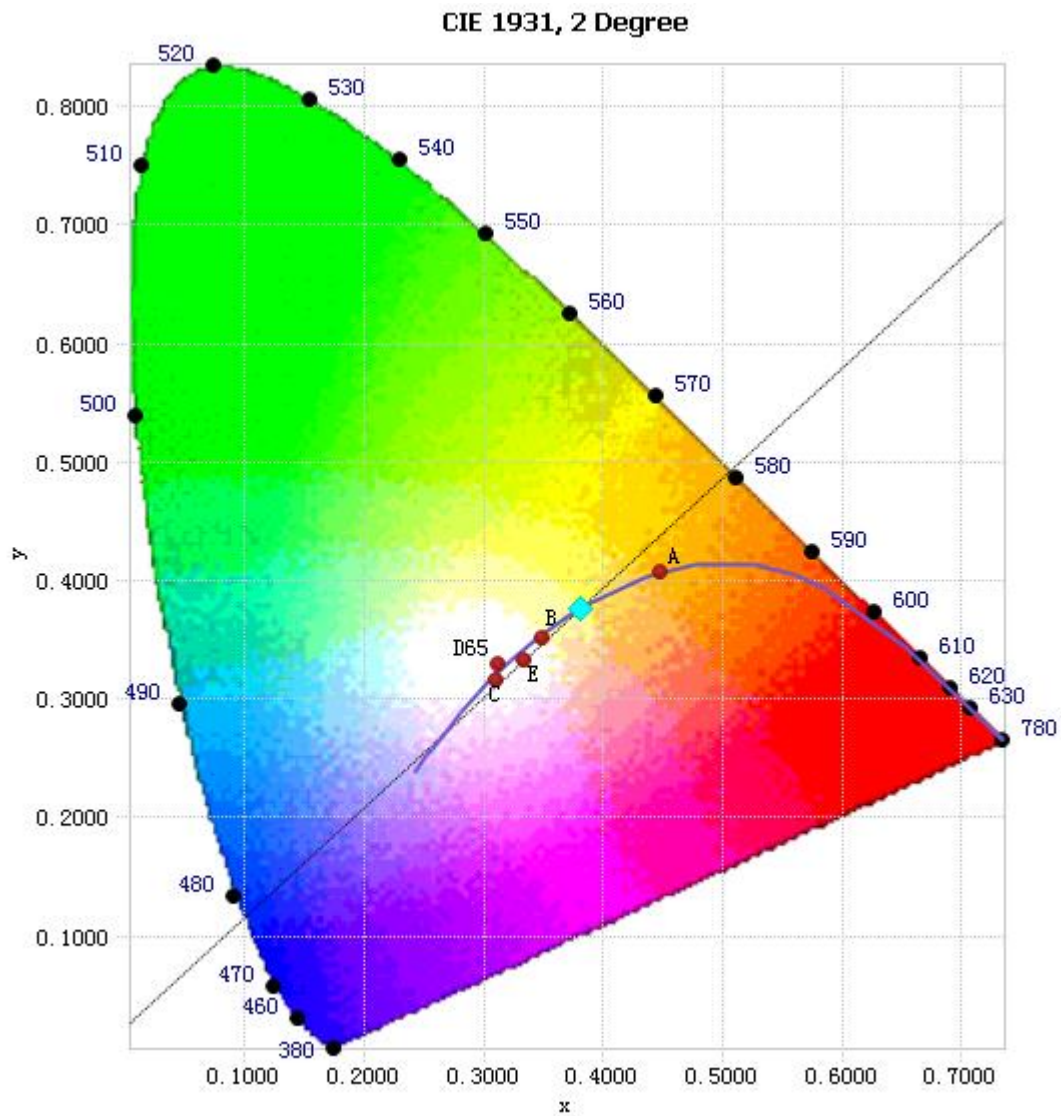
Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.28E-04	485	4.99E-03	590	1.33E-02	695	2.10E-03
385	1.33E-04	490	5.24E-03	595	1.33E-02	700	1.82E-03
390	1.41E-04	495	5.69E-03	600	1.32E-02	705	1.57E-03
395	1.58E-04	500	6.29E-03	605	1.29E-02	710	1.34E-03
400	1.74E-04	505	6.97E-03	610	1.26E-02	715	1.16E-03
405	2.15E-04	510	7.54E-03	615	1.21E-02	720	1.00E-03
410	2.96E-04	515	8.11E-03	620	1.14E-02	725	8.62E-04
415	4.56E-04	520	8.46E-03	625	1.07E-02	730	7.42E-04
420	7.38E-04	525	8.82E-03	630	1.00E-02	735	6.28E-04
425	1.19E-03	530	9.14E-03	635	9.22E-03	740	5.45E-04
430	1.94E-03	535	9.42E-03	640	8.45E-03	745	4.71E-04
435	3.08E-03	540	9.72E-03	645	7.65E-03	750	4.06E-04
440	4.79E-03	545	1.00E-02	650	6.88E-03	755	3.47E-04
445	7.48E-03	550	1.04E-02	655	6.16E-03	760	3.01E-04
450	1.13E-02	555	1.08E-02	660	5.49E-03	765	2.58E-04
455	1.37E-02	560	1.12E-02	665	4.83E-03	770	2.25E-04
460	1.17E-02	565	1.16E-02	670	4.24E-03	775	1.90E-04
465	8.91E-03	570	1.21E-02	675	3.71E-03	780	1.69E-04
470	7.43E-03	575	1.25E-02	680	3.24E-03		
475	6.11E-03	580	1.28E-02	685	2.82E-03		
480	5.15E-03	585	1.31E-02	690	2.44E-03		

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



## Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3803, 0.3766)

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

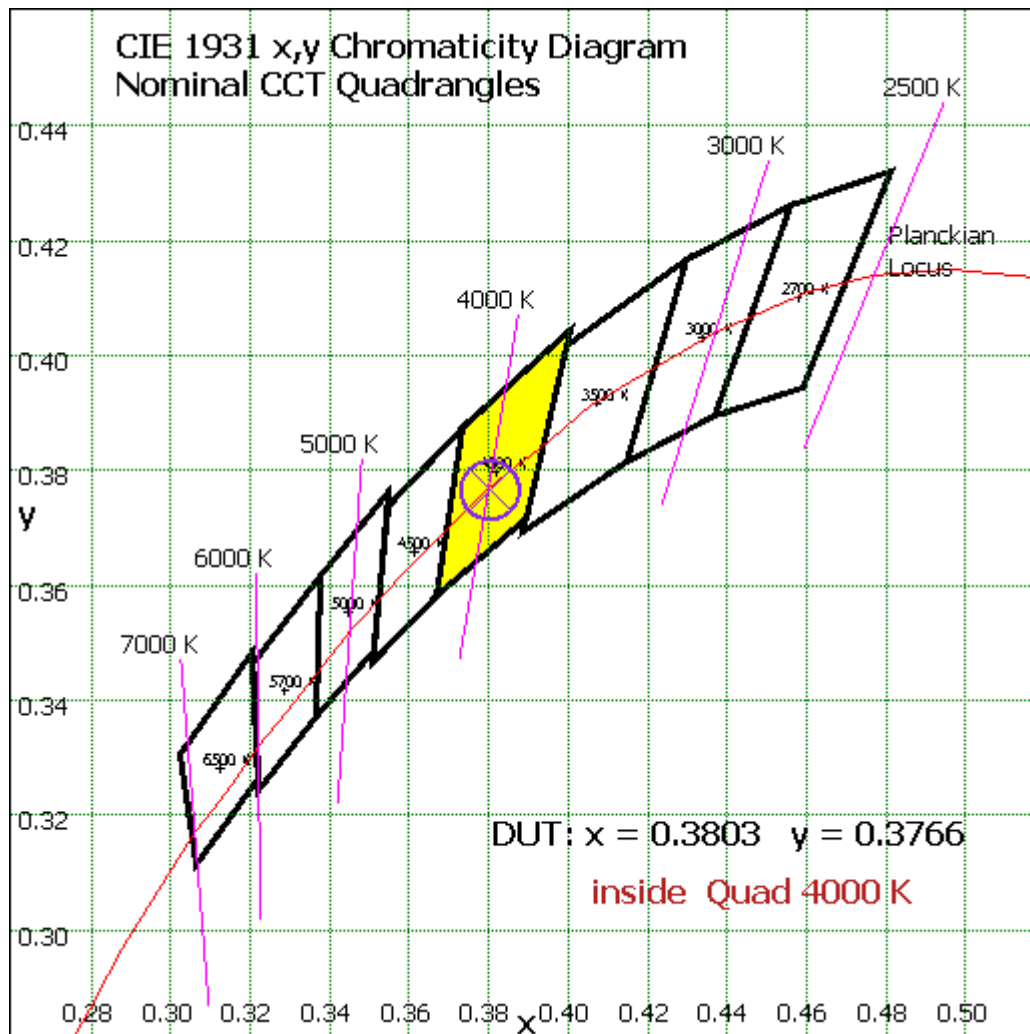
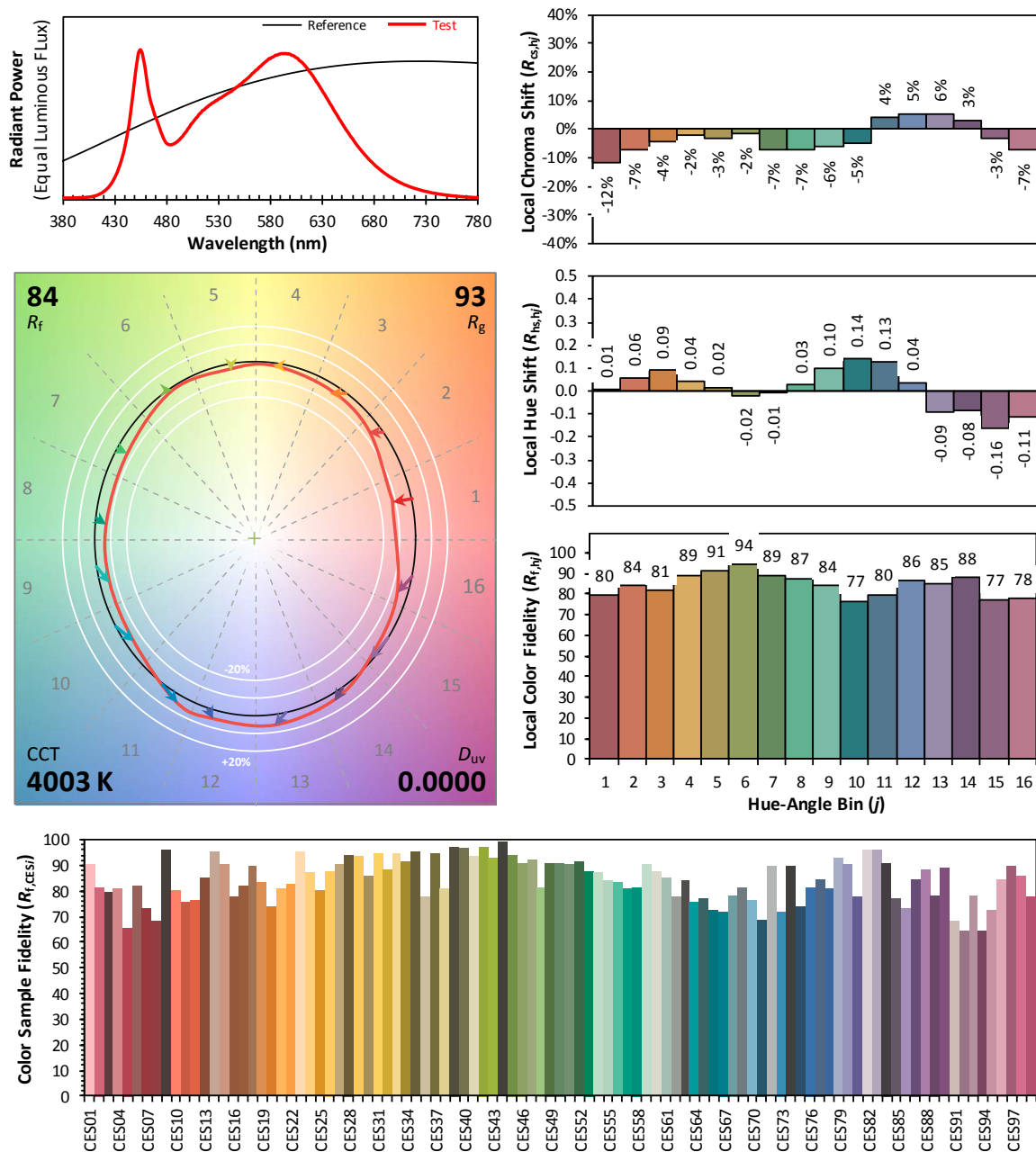


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

## Color Rendition Report – Sphere Spectroradiometer Method



Notes: This is a recommended method for displaying ANSI/IES TM-30-18 information.

$x$  0.3803  
 $y$  0.3766  
 $u'$  0.2251  
 $v'$  0.5015

Chart 4: Full Report Created with the IES TM-30 Calculator

Note: The values in this diagram might be a little different from the values in Table 2 due to rounding.

### Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	26.043	3.37%
10- 20	74.512	9.64%
20- 30	112.245	14.52%
30- 40	133.35	17.26%
40- 50	134.712	17.43%
50- 60	117.516	15.21%
60- 70	86.992	11.26%
70- 80	52.729	6.82%
80- 90	24.728	3.20%
90-100	7.846	1.02%
100-110	1.331	0.17%
110-120	0.169	0.02%
120-130	0.107	0.01%
130-140	0.138	0.02%
140-150	0.149	0.02%
150-160	0.128	0.02%
160-170	0.085	0.01%
170-180	0.03	0.00%
Total	772.8	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	598.378	77.43%
60- 90	164.449	21.28%
0-90	762.827	98.71%
90- 180	9.983	1.29%
0- 180	772.8	100%

Table 5: Zonal Lumen

## Illuminance Plots- Goniophotometer Method

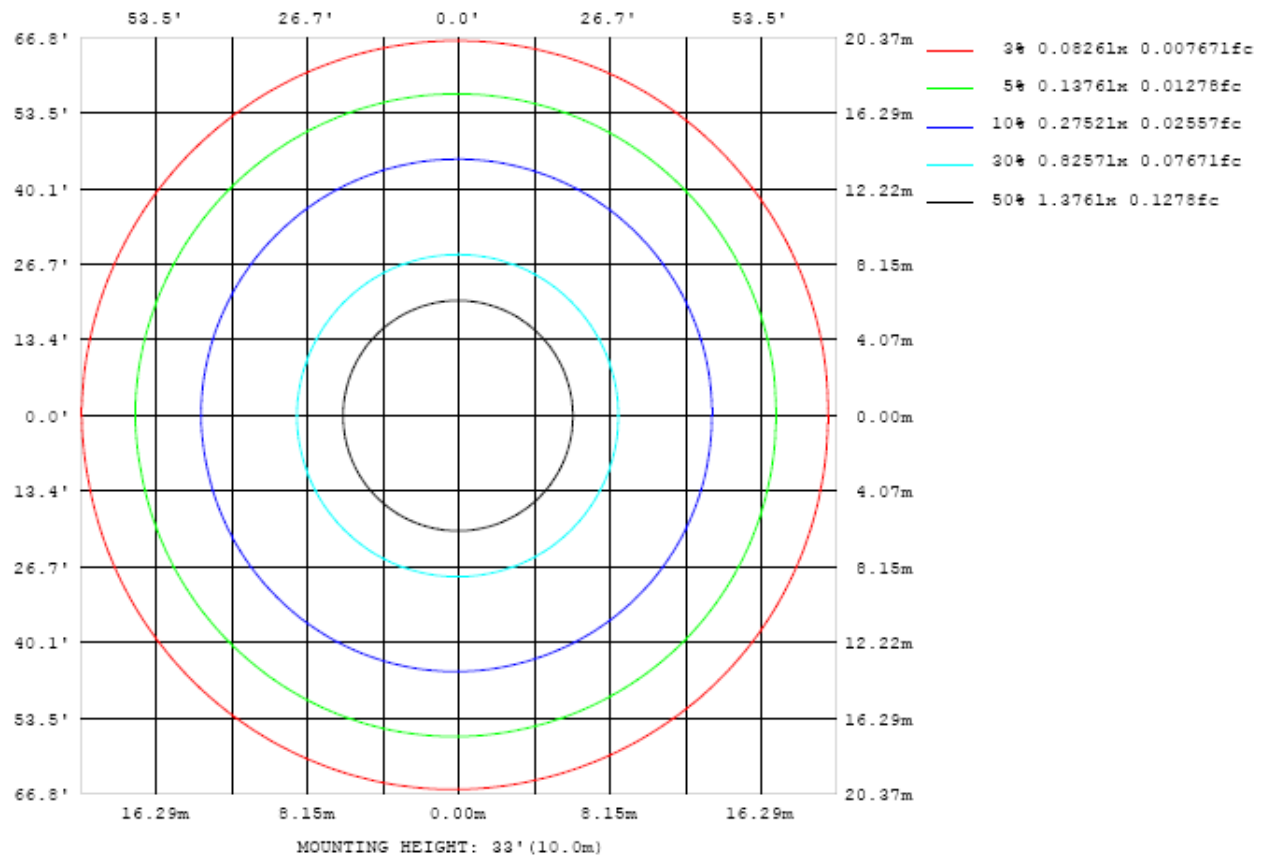


Chart 5: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

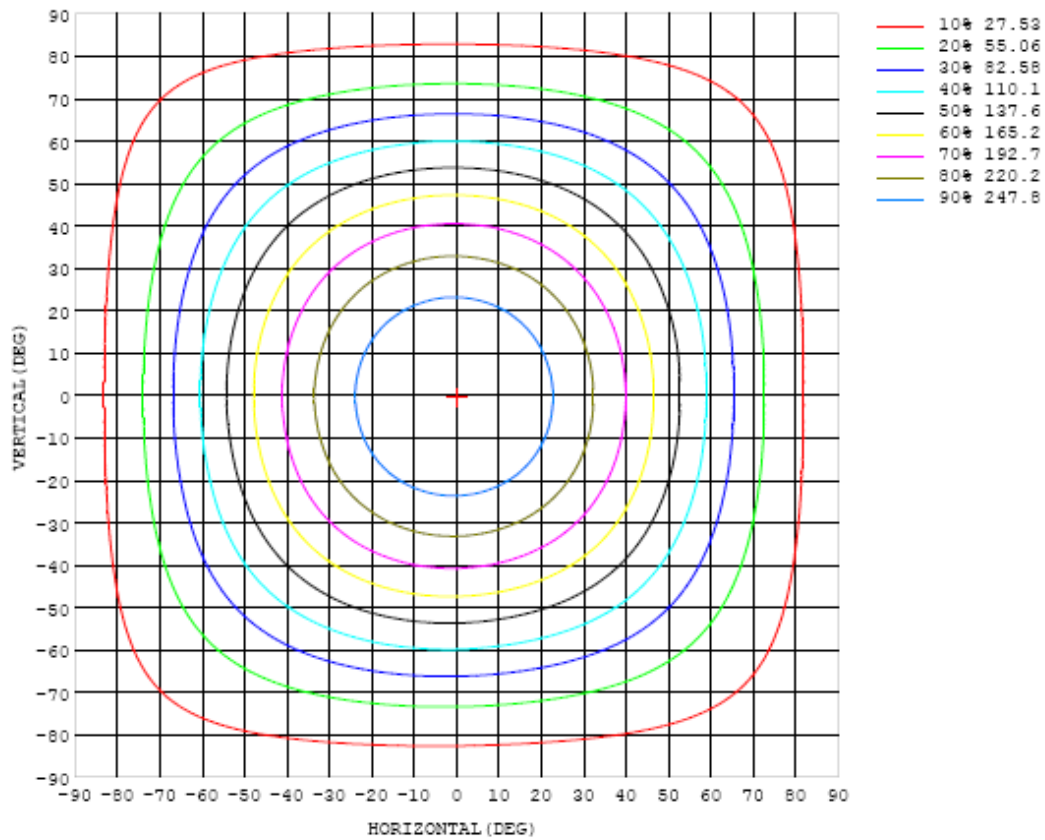


Chart 6: Isocandela Plot

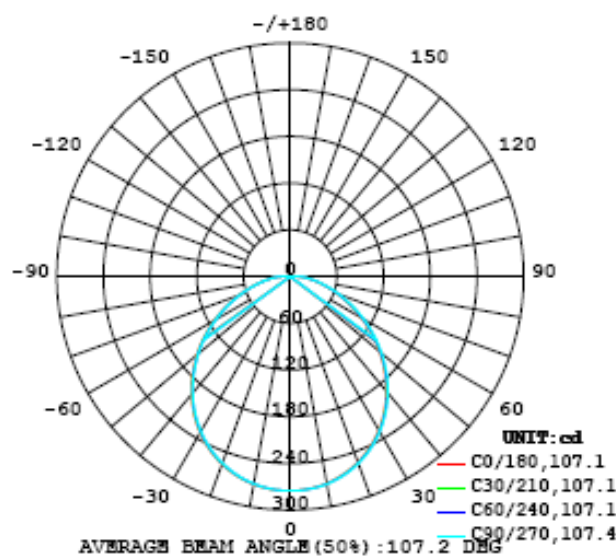


Chart 7: Polar Candela Distribution

## Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

C (DEG) Y (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275
5	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274
10	270	270	270	270	270	270	270	271	271	271	271	271	271	271	271	271	271	271	271
15	263	263	263	264	264	264	264	264	264	265	265	265	265	265	265	265	265	265	265
20	254	254	254	254	255	255	255	256	256	256	256	256	256	256	257	257	257	256	257
25	242	242	243	243	243	243	243	244	244	244	245	245	245	245	245	245	245	245	245
30	228	228	228	229	229	229	229	230	230	230	231	231	231	231	232	232	232	232	232
35	211	211	211	212	212	212	213	213	213	214	214	215	215	215	216	216	216	215	216
40	192	192	193	193	194	194	194	194	195	196	196	197	197	197	197	198	197	197	198
45	171	172	172	173	173	173	174	174	175	175	176	176	177	177	177	177	177	177	178
50	150	150	151	151	151	152	152	152	153	154	154	155	155	156	156	156	156	156	157
55	127	128	128	129	129	129	130	130	131	132	132	133	133	134	134	134	134	134	135
60	105	106	106	106	107	107	107	108	108	109	110	111	111	111	111	112	112	112	113
65	84.0	84.2	84.6	85.0	85.3	85.5	85.6	86.0	86.8	87.6	88.4	88.9	89.2	89.5	89.8	90.0	90.0	90.1	91.0
70	64.6	64.7	64.9	65.2	65.6	65.7	65.9	66.2	66.8	67.5	67.8	68.4	68.7	69.1	69.2	69.6	69.5	69.7	70.2
75	46.9	47.0	47.2	47.4	47.6	47.8	48.1	48.5	48.9	49.3	49.9	50.2	50.5	50.7	51.0	51.3	51.4	51.5	51.7
80	32.2	32.3	32.4	32.6	32.7	32.9	33.1	33.4	33.8	34.1	34.5	34.8	35.0	35.2	35.4	35.6	35.7	35.8	36.1
85	20.7	20.7	20.7	20.9	21.0	21.1	21.3	21.5	21.8	22.0	22.3	22.5	22.6	22.8	22.9	23.1	23.2	23.3	23.5
90	12.1	12.1	12.1	12.2	12.3	12.4	12.5	12.6	12.8	13.0	13.1	13.2	13.3	13.5	13.6	13.7	13.8	13.8	14.0
95	6.18	6.19	6.26	6.27	6.33	6.36	6.47	6.50	6.58	6.67	6.75	6.83	6.94	7.03	7.10	7.16	7.17	7.22	7.25
100	2.60	2.60	2.61	2.63	2.65	2.66	2.68	2.71	2.73	2.76	2.78	2.82	2.87	2.92	2.97	3.01	3.05	3.09	3.18
105	0.91	0.92	0.93	0.95	0.95	0.96	0.97	0.97	0.97	0.97	0.97	0.97	0.99	1.01	1.04	1.07	1.10	1.14	1.19
110	0.33	0.35	0.36	0.37	0.38	0.38	0.38	0.37	0.37	0.36	0.35	0.34	0.34	0.35	0.36	0.38	0.40	0.43	0.46
115	0.10	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.10	0.09	0.09	0.08	0.09	0.09	0.10	0.11	0.11	0.13	0.15
120	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.10
125	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.12
130	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.13	0.14	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.16
135	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.20
140	0.19	0.19	0.19	0.18	0.19	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.23
145	0.21	0.21	0.21	0.20	0.21	0.21	0.21	0.20	0.20	0.21	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.21	0.27
150	0.23	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.30
155	0.25	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.23	0.24	0.32
160	0.27	0.25	0.25	0.25	0.25	0.25	0.26	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.26	0.33
165	0.28	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.28	0.33
170	0.30	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.29	0.33
175	0.32	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.32
180	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31

Table 6: Luminous Intensity Data

Table--2 UNIT: cd

C (DEG) γ (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275		
5	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274		
10	271	271	271	271	270	270	270	270	270	270	270	270	270	270	270	270	270		
15	265	265	265	265	264	264	264	264	264	264	263	263	263	263	263	263	263		
20	256	256	256	256	256	255	255	255	255	254	254	254	254	254	254	254	254		
25	245	245	245	245	244	244	244	244	243	243	243	243	242	242	242	242	242		
30	231	231	231	231	230	230	230	230	229	229	229	228	228	228	228	227	227		
35	215	215	215	215	214	214	214	213	213	213	212	212	212	211	211	211	211		
40	197	197	196	196	196	196	195	195	195	194	194	194	193	193	192	192	192		
45	177	177	177	176	176	176	175	175	175	174	174	173	173	172	172	172	172		
50	156	156	156	156	155	155	154	154	154	154	153	153	152	152	151	151	151		
55	135	134	134	133	133	133	133	132	132	132	131	131	130	129	129	129	128		
60	112	112	112	111	111	110	110	110	110	110	109	109	108	107	107	106	106		
65	90.7	90.3	89.9	89.5	89.3	89.1	88.9	88.8	88.6	88.3	87.8	87.4	86.7	86.0	85.5	85.2	85.0		
70	70.0	69.7	69.4	69.1	68.8	68.6	68.5	68.5	68.3	68.0	67.6	67.2	66.5	66.0	65.5	65.2	65.0		
75	51.5	51.3	51.0	50.7	50.5	50.4	50.3	50.2	50.1	49.9	49.6	49.1	48.6	48.0	47.6	47.4	47.2		
80	36.0	35.8	35.6	35.4	35.2	35.1	35.1	35.0	34.9	34.7	34.5	34.1	33.7	33.2	32.9	32.7	32.5		
85	23.4	23.3	23.2	23.1	22.9	22.9	22.8	22.8	22.7	22.6	22.4	22.2	21.8	21.5	21.2	21.0	20.9		
90	13.9	13.9	13.8	13.7	13.6	13.6	13.6	13.6	13.5	13.4	13.2	13.0	12.8	12.6	12.4	12.3	12.2		
95	7.24	7.25	7.23	7.20	7.16	7.13	7.10	7.08	7.02	6.97	6.89	6.79	6.66	6.53	6.42	6.32	6.26		
100	3.19	3.20	3.20	3.19	3.16	3.14	3.12	3.09	3.05	3.02	2.97	2.92	2.86	2.79	2.73	2.69	2.66		
105	1.20	1.21	1.22	1.21	1.20	1.19	1.17	1.15	1.12	1.09	1.06	1.03	1.00	0.97	0.95	0.94	0.93		
110	0.48	0.49	0.50	0.51	0.51	0.50	0.48	0.46	0.44	0.42	0.39	0.37	0.35	0.34	0.34	0.34	0.34		
115	0.16	0.17	0.18	0.18	0.18	0.18	0.17	0.16	0.15	0.14	0.12	0.11	0.10	0.10	0.10	0.10	0.10		
120	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.10		
125	0.12	0.12	0.12	0.12	0.12	0.12	0.13	0.12	0.12	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13		
130	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16		
135	0.19	0.20	0.19	0.19	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20		
140	0.24	0.23	0.24	0.23	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24		
145	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.28	0.28	0.28	0.28		
150	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.31		
155	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32		
160	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33		
165	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.34	0.33		
170	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33		
175	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32		
180	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31		

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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