

LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

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

LED Tube

Model: 20.5T8/4F/850/BYP

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ19070027b

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

Review by:



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Jul. 19, 2019

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Jul. 19, 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: 20.5T8/4F/850/BYP

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
155.2	3196.3	20.59	0.9736
CCT (K)	CRI	Stabilization Time (Light & Power)	
5040	82.2	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	: Jul. 17, 2019
Date of Test	: Jul. 18, 2019
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 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)

Name	: LED Tube
Model	: 20.5T8/4F/850/BYP
Electrical Ratings	: 120-277V, 50/60Hz, 20.5W
Product Description	: 5000K
Manufacturer	: GREEN CREATIVE LTD
Address	: 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 65 minutes.

Sphere-Spectroradiometer Method

Parameter	Result	
Test Voltage (V)	120.0	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.176	0.082
Power Factor	0.9736	0.9160
Test Power (W)	20.59	20.73
THD A%	20.83	19.77
Luminous Efficacy (lm/W)	155.2	154.9
Total Luminous Flux (lm)	3196.3	3210.9
Color Rendering Index (CRI)	82.2	
R9	3.2	
Correlated Color Temperature (CCT)(K)	5040	
Chromaticity Chroma x	0.3444	
Chromaticity Chroma y	0.3567	
Chromaticity Chroma u	0.2090	
Chromaticity Chroma v	0.3247	
Duv	0.0028	
Chromaticity Chroma u'	0.2090	
Chromaticity Chroma v'	0.4870	

Special Color Rendering Indices	
R1	80.3
R2	87.8
R3	92.6
R4	81.6
R5	80.9
R6	82.6
R7	86.4
R8	65.6
R9	3.2
R10	70.7
R11	80.6
R12	58.9
R13	82.3
R14	96.2

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 25.0 °C.

The photometric distance is 30 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)	0.176
Power Factor	0.9740
Power (W)	20.58
Luminous Efficacy (lm/W)	153.1
Total Luminous Flux (lm)	3149.9
Beam Angle (°)	114.8 (0°-180°) / 234.4 (90°-270°)
Center Beam Candle Power (cd)	493
Maximum Beam Candle Power (cd)	493.9 (At: C=120.0, Gamma=2.0)
Spacing Criteria	1.28 (0°-180°) / 1.45 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	41.10%
Zonal Lumens in the 60 °-90 °Zone	26.48%
Zonal Lumens in the 90 °-120 °Zone	18.11%
Zonal Lumens in the 120 °-180 °Zone	14.32%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

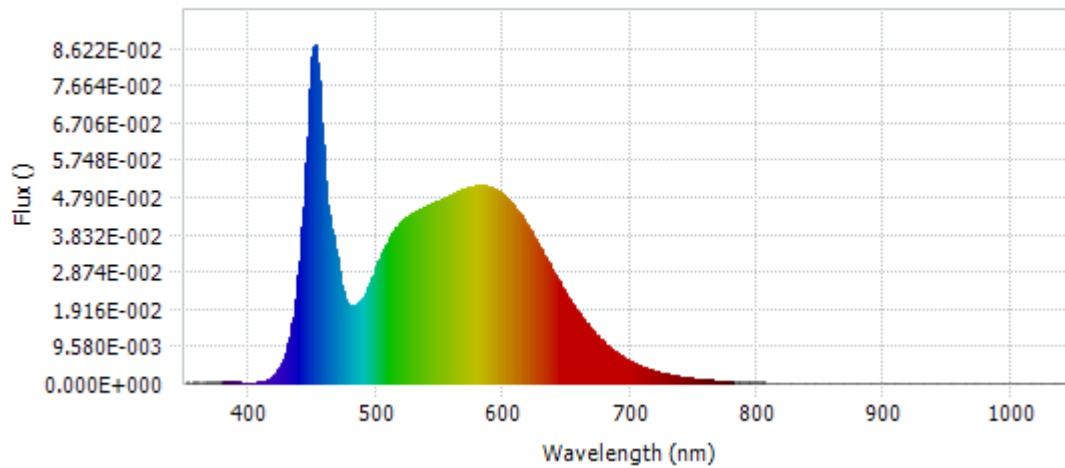
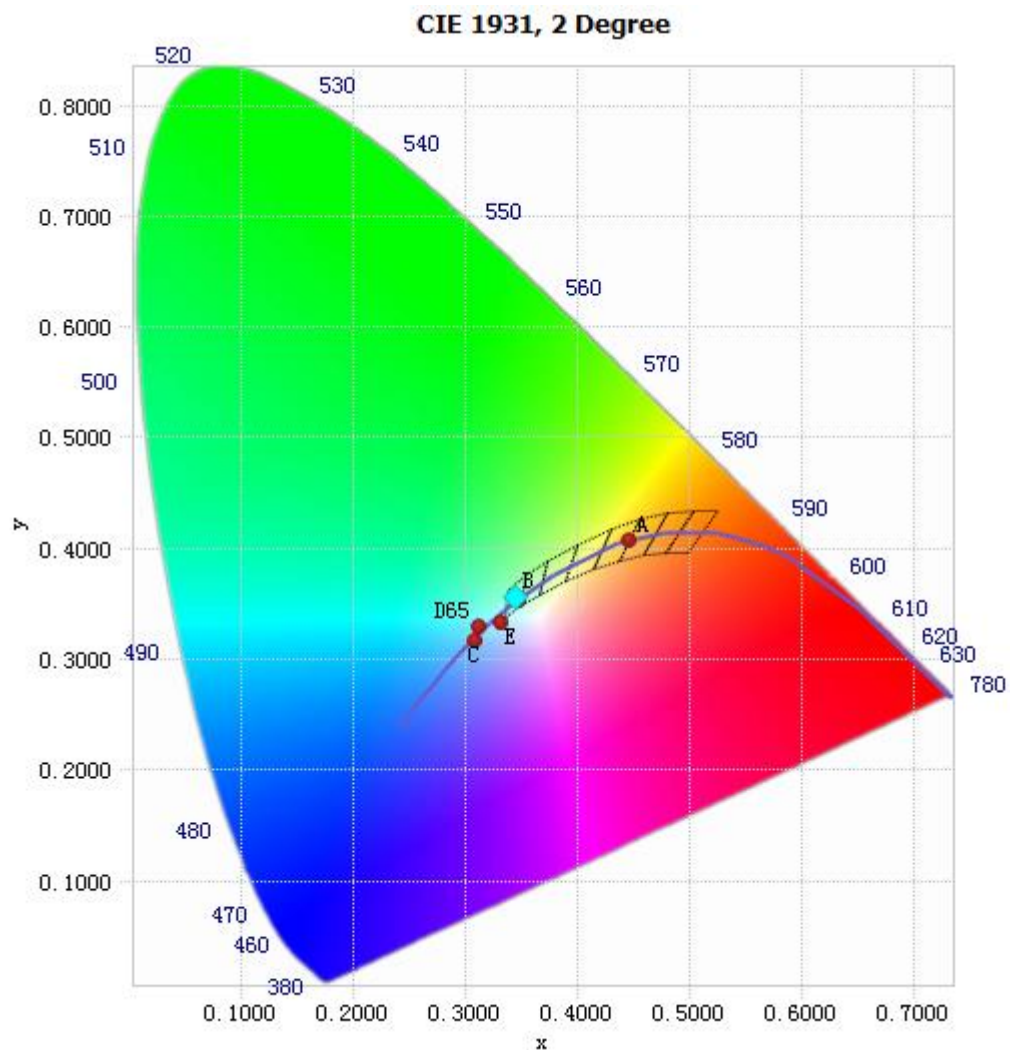


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	3.04E-04	485	2.03E-02	590	5.04E-02	695	6.59E-03
385	3.06E-04	490	2.22E-02	595	4.96E-02	700	5.66E-03
390	2.88E-04	495	2.55E-02	600	4.85E-02	705	4.86E-03
395	2.29E-04	500	2.97E-02	605	4.68E-02	710	4.14E-03
400	1.70E-04	505	3.37E-02	610	4.49E-02	715	3.56E-03
405	1.84E-04	510	3.68E-02	615	4.26E-02	720	3.05E-03
410	4.23E-04	515	3.96E-02	620	3.99E-02	725	2.63E-03
415	9.64E-04	520	4.15E-02	625	3.72E-02	730	2.25E-03
420	2.12E-03	525	4.28E-02	630	3.43E-02	735	1.92E-03
425	4.47E-03	530	4.40E-02	635	3.13E-02	740	1.64E-03
430	8.98E-03	535	4.47E-02	640	2.85E-02	745	1.40E-03
435	1.72E-02	540	4.56E-02	645	2.55E-02	750	1.21E-03
440	3.16E-02	545	4.64E-02	650	2.28E-02	755	1.03E-03
445	5.66E-02	550	4.71E-02	655	2.02E-02	760	8.91E-04
450	8.41E-02	555	4.78E-02	660	1.78E-02	765	7.58E-04
455	7.80E-02	560	4.85E-02	665	1.56E-02	770	6.51E-04
460	5.21E-02	565	4.93E-02	670	1.36E-02	775	5.57E-04
465	3.96E-02	570	5.00E-02	675	1.18E-02	780	4.83E-04
470	3.07E-02	575	5.04E-02	680	1.03E-02		
475	2.26E-02	580	5.07E-02	685	8.90E-03		
480	1.98E-02	585	5.08E-02	690	7.69E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3444, 0.3567)

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

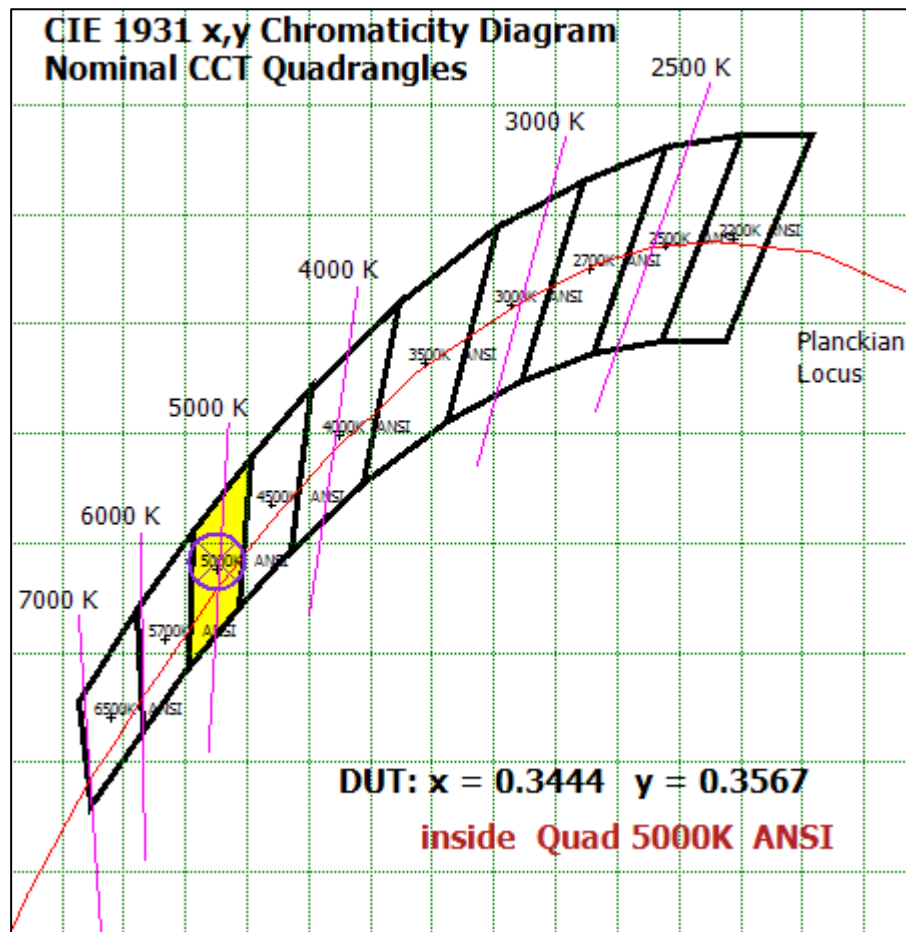
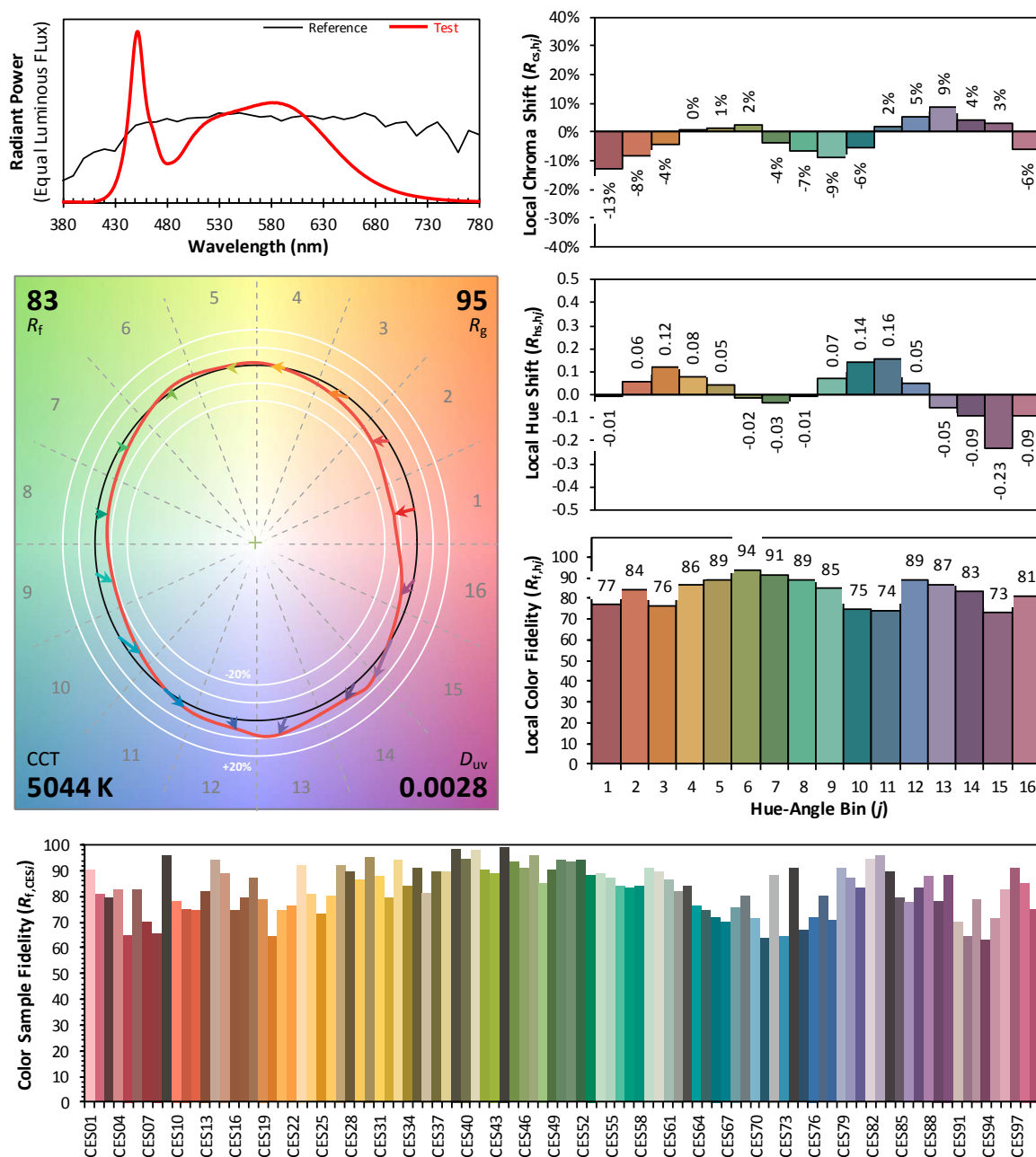


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x 0.3444

y 0.3567

u' 0.2090

v' 0.4870

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	46.869	1.49%
10- 20	136.339	4.33%
20- 30	213.539	6.78%
30- 40	271.949	8.63%
40- 50	307.344	9.76%
50- 60	318.461	10.11%
60- 70	307.371	9.76%
70- 80	280.046	8.89%
80- 90	246.572	7.83%
90-100	217.049	6.89%
100-110	189.759	6.02%
110-120	163.696	5.20%
120-130	138.733	4.40%
130-140	114.404	3.63%
140-150	89.607	2.84%
150-160	63.308	2.01%
160-170	34.714	1.10%
170-180	10.143	0.32%
Total	3149.9	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1294.501	41.10%
60- 90	833.989	26.48%
0-90	2128.49	67.57%
90- 180	1021.413	32.43%
0- 180	3149.9	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

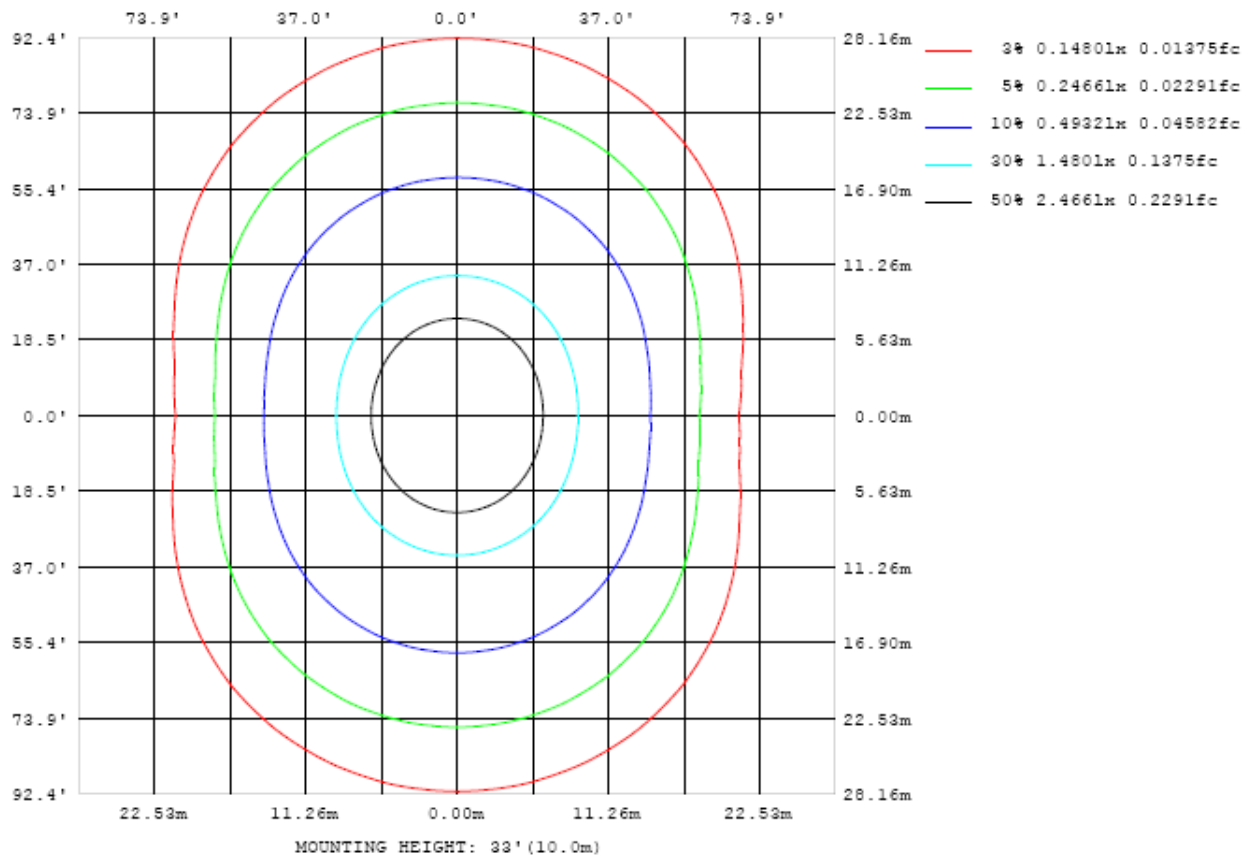


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

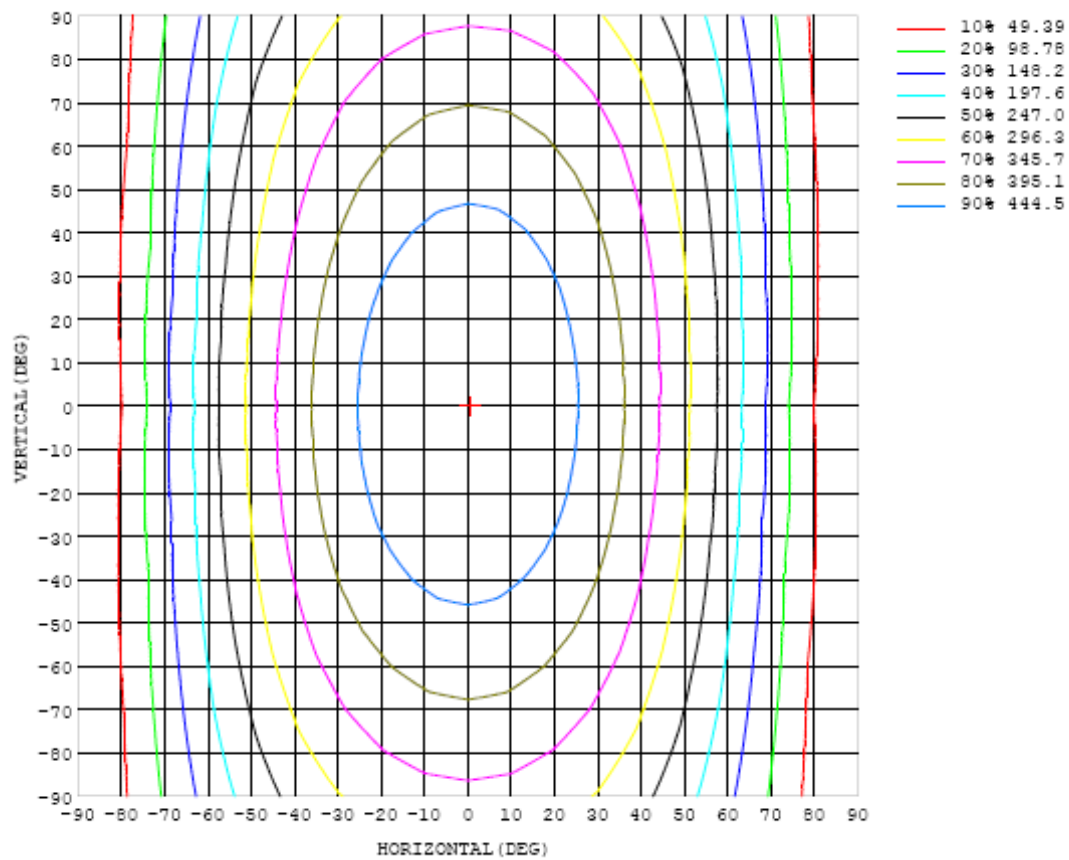


Chart 6: Isocandela Plot

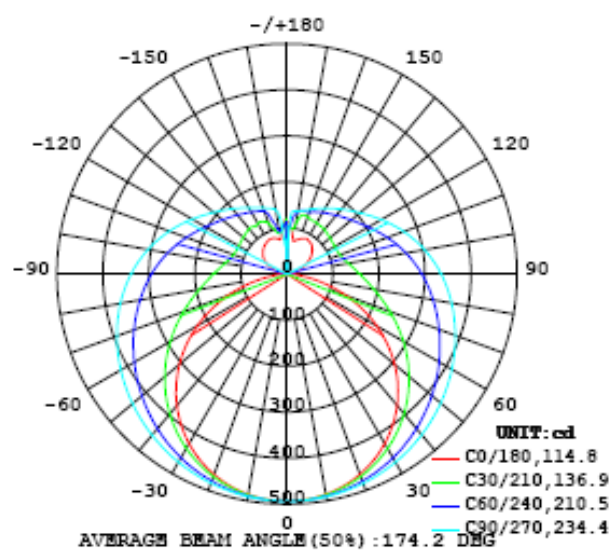


Chart 7: Polar Candela Distribution

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	493	493	493	493	493	493	493	493	493	493	493	493	493	493	493	493	493	493	493
5	492	491	492	492	492	493	493	493	493	493	493	493	493	493	492	492	492	492	492
10	486	486	486	487	488	489	490	490	491	491	491	490	490	490	488	487	487	486	486
15	476	477	478	479	481	483	485	486	488	488	488	487	485	484	481	479	478	477	477
20	463	463	466	468	472	475	479	481	483	484	484	482	479	476	472	468	466	464	463
25	446	447	450	454	460	466	470	475	477	478	478	475	471	466	460	455	450	447	446
30	425	426	431	437	446	454	461	466	470	472	471	467	461	455	446	438	431	427	425
35	401	402	409	418	429	440	450	457	463	464	463	458	451	441	430	419	410	403	401
40	372	375	384	396	411	425	438	447	454	455	454	448	438	426	412	397	384	375	372
45	341	344	356	372	391	409	425	436	444	446	444	437	425	411	392	373	357	344	340
50	305	310	325	346	370	392	411	424	433	436	433	425	411	394	371	348	326	310	305
55	267	273	293	319	349	375	397	412	422	425	422	413	397	376	350	322	295	274	267
60	225	234	259	292	327	357	382	399	410	414	410	400	382	359	329	295	262	235	225
65	181	192	224	265	305	340	367	386	398	402	398	387	367	341	307	268	228	195	181
70	136	150	190	238	284	322	352	373	386	389	386	373	352	324	286	243	196	154	137
75	90.4	109	159	214	264	305	337	359	373	377	372	359	338	307	267	219	166	115	91.0
80	48.4	73.0	131	192	246	290	322	345	359	363	359	345	323	291	249	198	139	80.9	48.5
85	14.8	45.5	109	173	229	274	308	331	345	350	345	331	308	276	233	180	119	55.5	15.6
90	0.87	31.1	94.3	158	214	259	293	317	331	335	331	317	294	261	218	165	104	41.2	0.53
95	4.20	27.1	84.6	146	200	245	278	301	316	320	316	302	279	247	205	153	94.1	36.0	3.82
100	11.8	31.0	79.1	135	187	230	263	286	299	304	300	286	264	233	192	143	87.9	38.3	11.4
105	21.4	38.9	78.3	128	175	216	247	269	283	287	283	270	249	219	180	134	85.9	44.5	21.6
110	32.0	48.2	80.7	123	165	203	232	253	266	270	266	254	234	206	170	128	87.6	53.5	32.7
115	42.6	57.5	85.0	120	157	191	217	237	249	253	249	238	219	193	161	126	91.2	63.5	43.9
120	52.9	69.0	90.6	120	151	180	204	222	233	237	233	223	205	182	155	125	95.9	73.6	54.5
125	62.6	77.2	96.3	121	147	172	192	208	218	221	218	208	194	174	151	125	101	82.2	62.8
130	70.9	85.9	103	122	144	165	183	196	204	207	205	197	184	167	147	126	107	87.0	68.9
135	77.8	93.4	107	124	142	159	174	185	192	195	193	186	175	161	145	127	112	94.2	73.8
140	83.4	101	112	126	141	155	167	176	182	184	182	176	168	156	143	129	116	103	77.7
145	85.8	106	115	127	139	150	160	167	172	174	172	168	161	151	141	131	117	109	80.9
150	88.0	112	120	128	138	147	154	160	164	165	164	160	155	148	140	131	117	116	83.4
155	85.5	108	124	128	136	143	149	153	156	157	156	153	149	145	138	126	116	115	84.3
160	80.8	98.6	126	132	137	140	143	146	149	150	150	147	146	140	129	117	108	103	82.9
165	76.1	84.5	107	133	136	140	142	143	143	143	143	143	138	122	111	100	95.3	89.7	79.4
170	77.0	77.5	87.1	110	128	133	136	139	139	139	138	132	112	96.8	94.9	96.2	93.7	84.7	79.4
175	102	97.0	94.5	100	104	106	113	122	135	136	116	82.0	79.1	92.4	97.9	100	102	101	103
180	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56

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	493	493	493	493	493	493	493	493	493	493	493	493	493	493	493	493	493		
5	492	492	492	492	492	493	492	493	493	493	493	492	493	492	492	492	492		
10	486	487	487	488	489	490	490	491	491	491	490	489	489	488	487	486	486		
15	477	478	479	481	483	485	486	487	487	487	486	485	483	481	479	478	477		
20	464	466	468	472	475	478	481	483	483	483	481	479	476	472	468	466	464		
25	447	450	454	460	465	470	474	477	478	478	475	471	466	460	455	450	447		
30	427	431	437	446	454	461	467	471	472	471	467	462	455	446	438	432	427		
35	403	409	418	429	440	450	458	463	465	464	459	451	442	431	420	410	404		
40	375	384	396	411	425	438	448	454	457	455	450	440	428	413	399	386	377		
45	344	356	372	391	409	425	437	445	448	446	439	428	413	395	376	359	346		
50	310	325	347	371	393	412	426	435	438	436	428	415	397	375	351	329	313		
55	273	293	320	349	376	398	414	424	428	426	417	401	381	354	326	298	277		
60	234	259	293	327	358	383	401	413	417	415	405	387	364	333	299	265	238		
65	193	225	266	306	341	368	389	401	406	403	392	373	347	313	273	232	198		
70	152	192	240	285	323	354	375	389	393	391	379	359	330	293	248	200	158		
75	112	161	215	265	307	339	362	376	381	378	366	344	314	273	224	169	118		
80	75.2	134	194	247	291	324	348	363	368	365	352	330	298	255	203	142	82.9		
85	47.5	112	175	231	275	309	334	348	354	350	338	315	283	239	185	121	55.8		
90	32.9	96.9	160	215	260	295	319	334	339	336	323	300	268	224	169	106	40.8		
95	28.4	86.8	147	201	245	279	303	318	323	320	307	285	253	209	156	95.1	35.2		
100	31.8	81.1	137	188	230	264	287	302	307	304	291	269	237	196	145	88.2	36.8		
105	39.1	80.0	129	176	216	248	271	285	290	286	274	253	223	183	136	85.5	43.1		
110	49.3	82.7	124	166	203	233	254	267	272	269	258	237	209	172	129	86.5	52.3		
115	60.1	87.4	122	158	191	218	238	251	255	252	241	222	196	163	126	89.7	62.7		
120	70.6	93.1	121	152	180	204	223	234	238	235	225	208	185	156	125	94.3	72.7		
125	80.7	99.3	122	148	173	193	209	219	222	220	211	196	176	151	125	100	82.6		
130	89.3	105	124	145	166	183	197	205	208	206	199	186	168	148	126	107	91.8		
135	97.6	109	126	143	160	175	186	194	196	194	188	177	162	145	128	113	100		
140	105	116	128	142	155	167	177	183	185	183	178	169	157	143	130	118	108		
145	110	121	126	141	151	161	168	173	175	174	169	163	153	142	132	124	114		
150	115	126	127	140	148	155	161	166	166	166	163	157	150	142	134	128	119		
155	111	124	126	130	144	150	154	158	159	159	157	153	147	142	137	132	116		
160	92.5	109	116	120	130	145	149	152	153	153	152	149	145	142	139	133	105		
165	80.6	92.5	98.4	102	108	117	139	147	147	148	147	146	144	141	138	126	88.3		
170	79.4	81.0	90.0	96.6	98.8	93.7	102	117	141	143	143	142	136	135	124	101	82.6		
175	102	102	101	102	102	101	94.5	78.5	79.2	128	122	112	109	109	105	102	101		
180	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56		

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 4π . 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° 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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