



LM-79-19 TEST REPORT

for

ESPEN TECHNOLOGY INC.

12257 FLORENCE AVE SANTA FE SPRINGS LOS ANGELES CA 90670, USA

LED Tube

Model: L48T8/830/8G-ID DE (a)

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ25090032a

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

Review by:

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April Zou

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Sep. 23, 2025

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Sep. 23, 2025

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: **L48T8/830/8G-ID DE (a)**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
188.4	1601.1	8.50	0.9757
CCT (K)	CRI	Stabilization Time (Light & Power)	
3041	81.8	50	

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. 30, 2024
Date of Test	: Jul. 31, 2024
Test item	: Total Luminous Flux, Luminous Distribution Intensity, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters
Reference Standard	: IESNA LM-79-2019 Approved Method: 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	: L48T8/830/8G-ID DE (a)
Electrical Ratings	: 120-277V, 50/60Hz, 8.5W
Product Description	: 3000K

TEST RESULTS

Test ambient temperature was 26.0 °C.

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

The stabilization time of the sample was 50 minutes, and the total operating time including stabilization was 55 minutes.

Sphere-Spectroradiometer Method

Parameter	Result	
	Test Voltage (V)	120.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.073	0.033
Power Factor	0.9757	0.9418
Test Power (W)	8.50	8.70
THD A%	18.78	14.67
Luminous Efficacy (lm/W)	188.4	185.4
Total Luminous Flux (lm)	1601.1	1613.3
Color Rendering Index (CRI)	81.8	
R9	8.9	
Correlated Color Temperature (CCT)(K)	3041	
Chromaticity Chroma x	0.4362	
Chromaticity Chroma y	0.4077	
Chromaticity Chroma u	0.2485	
Chromaticity Chroma v	0.3485	
Duv	0.0016	
Chromaticity Chroma u'	0.2485	
Chromaticity Chroma v'	0.5227	

Special Color Rendering Indices	
R1	79.4
R2	88.7
R3	96.6
R4	79.4
R5	79.1
R6	85.8
R7	84.1
R8	60.9
R9	8.9
R10	73.9
R11	77.6
R12	65
R13	81
R14	98.1

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 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)	0.073
Power Factor	0.9815
Power (W)	8.54
Luminous Efficacy (lm/W)	189.0
Total Luminous Flux (lm)	1613.8
Beam Angle (°)	111.3 (0°-180°) / 205.7 (90°-270°)
Center Beam Candle Power (cd)	285
Maximum Beam Candle Power (cd)	287.8 (At: C=260.0, Gamma=9.0)
Spacing Criteria	1.28 (0°-180°) / 1.48 (90°-270°)
Zonal Lumens in the 0°-60° Zone	44.38%
Zonal Lumens in the 60°-90° Zone	26.53%
Zonal Lumens in the 90°-120° Zone	17.29%
Zonal Lumens in the 120°-180° Zone	11.79%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

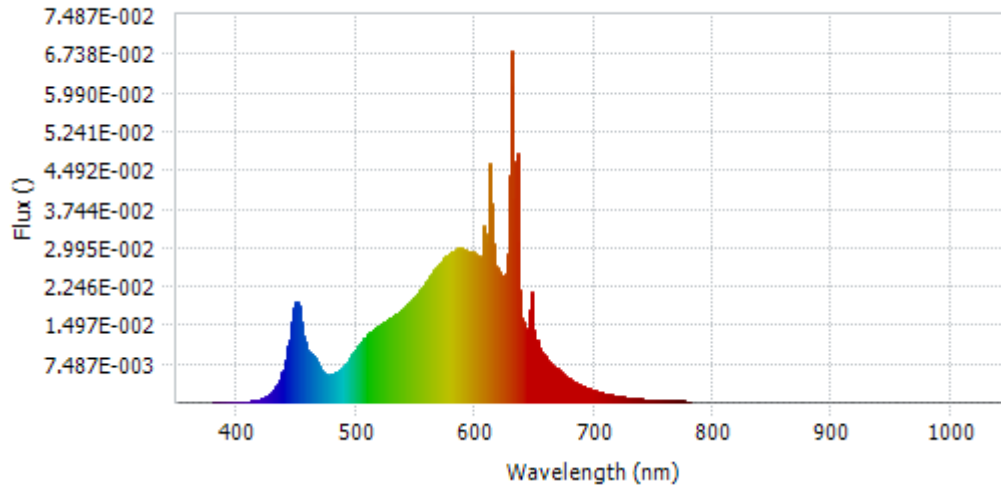
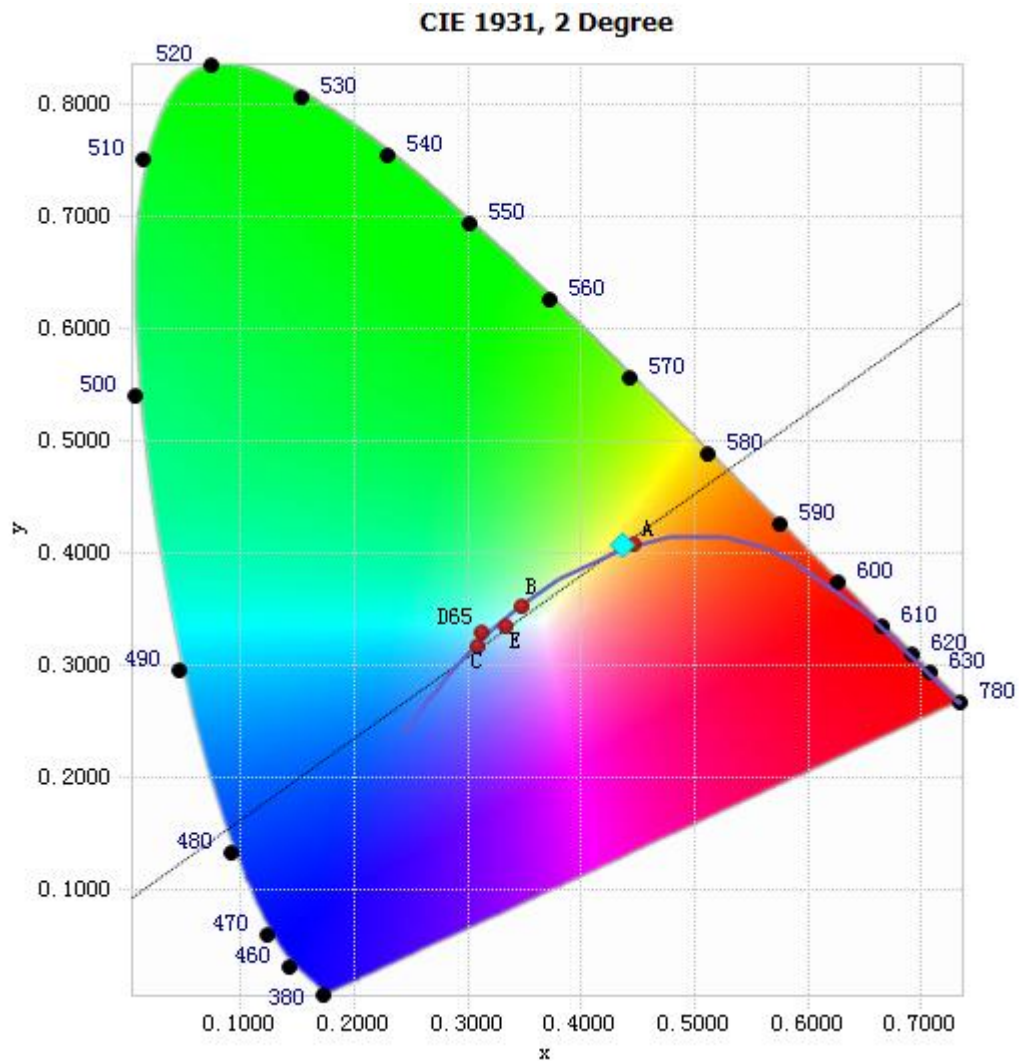


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	9.85E-05	485	6.00E-03	590	2.96E-02	695	2.64E-03
385	7.86E-05	490	6.96E-03	595	2.91E-02	700	2.24E-03
390	1.02E-04	495	8.51E-03	600	2.86E-02	705	1.89E-03
395	7.67E-05	500	1.03E-02	605	2.77E-02	710	1.60E-03
400	7.46E-05	505	1.18E-02	610	2.89E-02	715	1.36E-03
405	8.37E-05	510	1.30E-02	615	3.05E-02	720	1.16E-03
410	1.50E-04	515	1.42E-02	620	2.52E-02	725	9.81E-04
415	3.16E-04	520	1.49E-02	625	2.46E-02	730	8.47E-04
420	6.18E-04	525	1.57E-02	630	6.81E-02	735	7.14E-04
425	1.15E-03	530	1.64E-02	635	4.82E-02	740	6.01E-04
430	2.18E-03	535	1.72E-02	640	1.54E-02	745	5.21E-04
435	3.96E-03	540	1.82E-02	645	1.41E-02	750	4.47E-04
440	7.25E-03	545	1.93E-02	650	1.25E-02	755	3.80E-04
445	1.38E-02	550	2.05E-02	655	1.02E-02	760	3.31E-04
450	1.94E-02	555	2.20E-02	660	8.53E-03	765	2.82E-04
455	1.42E-02	560	2.36E-02	665	7.04E-03	770	2.40E-04
460	9.85E-03	565	2.53E-02	670	6.40E-03	775	2.06E-04
465	8.75E-03	570	2.67E-02	675	5.14E-03	780	1.82E-04
470	6.54E-03	575	2.80E-02	680	4.31E-03		
475	5.27E-03	580	2.89E-02	685	3.67E-03		
480	5.42E-03	585	2.96E-02	690	3.12E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4362, 0.4077)

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

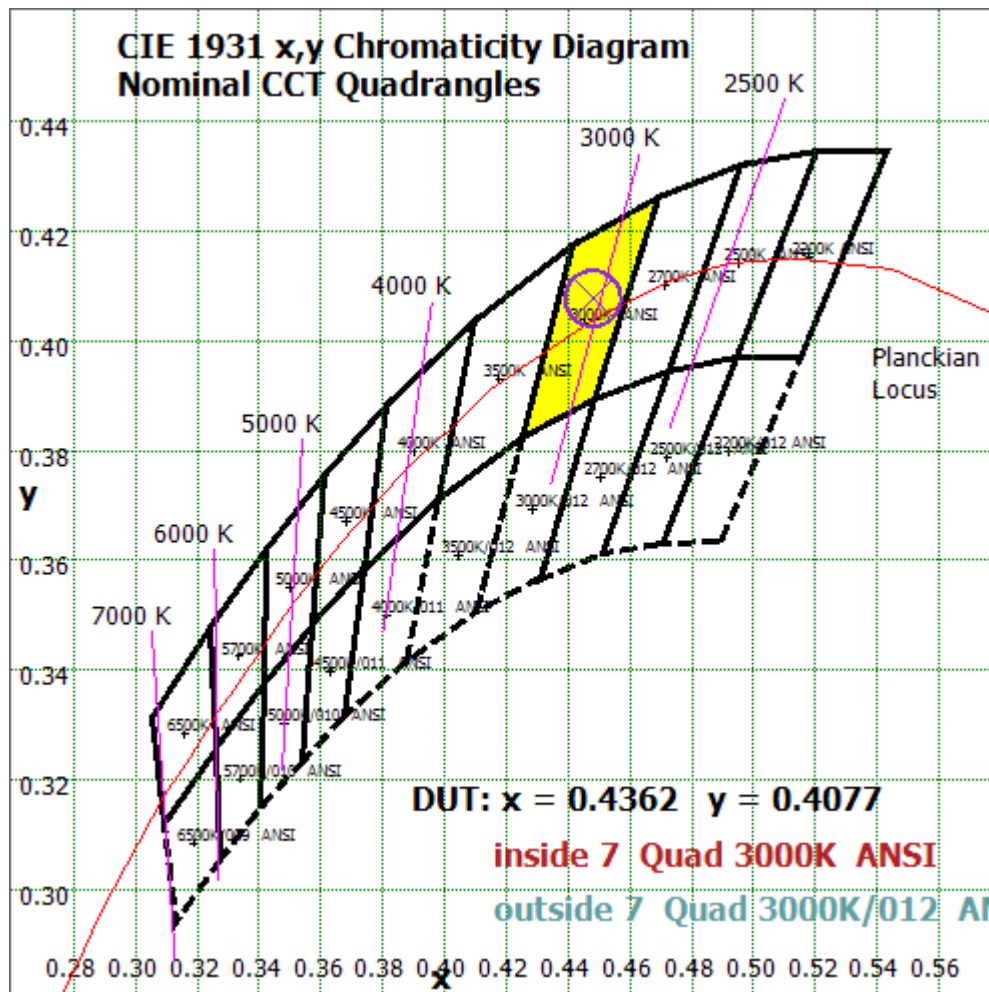


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

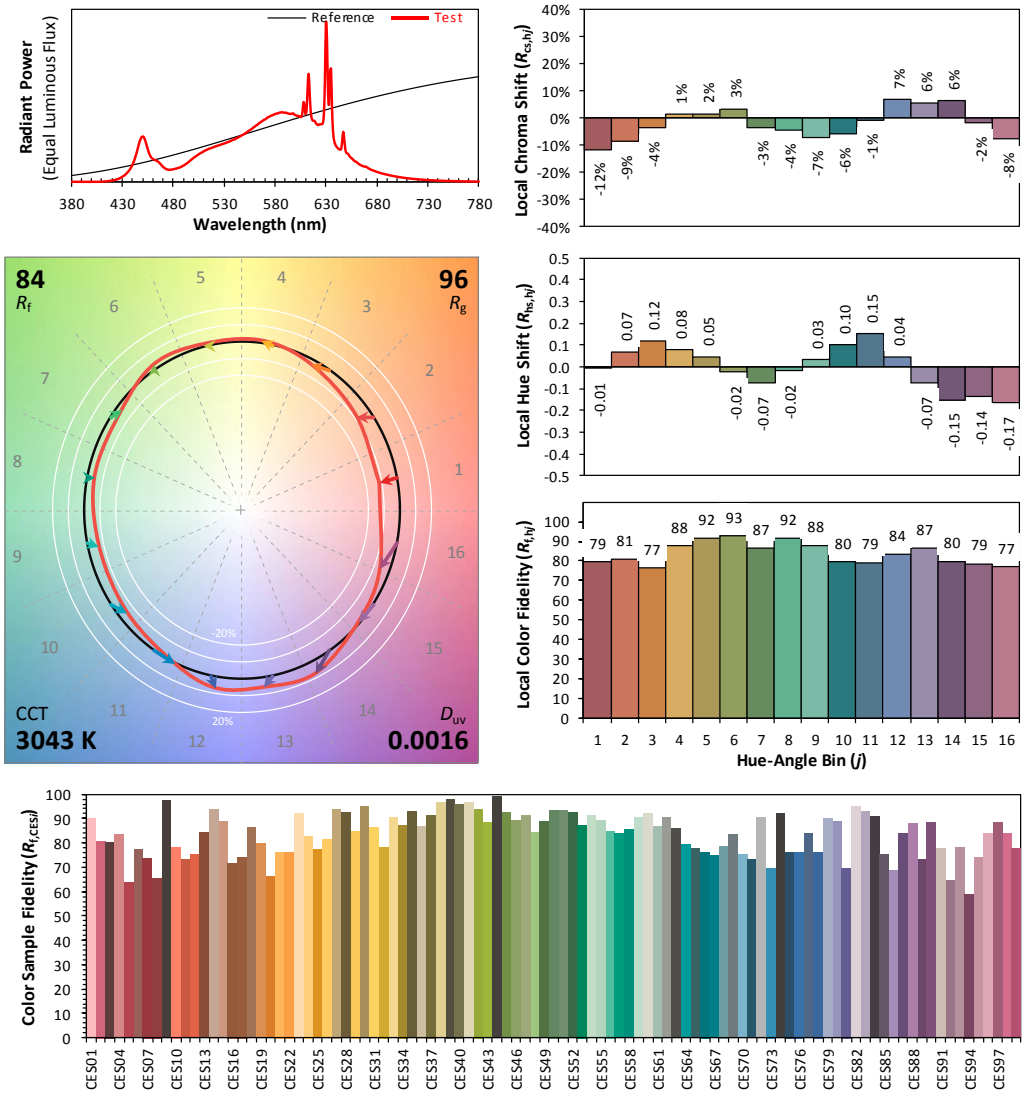
ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: ESPEN TECHNOLOGY INC.

Date: 2024/07/31

Model: L48T8/830/8G-ID DE (a)



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

x 0.4362
 y 0.4077
 u' 0.2485
 v' 0.5227

CIE 13.3-1995 (CRI)	
R_a	82
R_9	9

Colors are for visual orientation purposes only. Created with the ANSI/IES TM-30-18 Calculator Version 2.00.

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	26.99	1.67%
10- 20	78.003	4.83%
20- 30	120.807	7.49%
30- 40	151.552	9.39%
40- 50	168.176	10.42%
50- 60	170.75	10.58%
60- 70	161.24	9.99%
70- 80	143.508	8.89%
80- 90	123.422	7.65%
90-100	106.637	6.61%
100-110	92.639	5.74%
110-120	79.773	4.94%
120-130	66.51	4.12%
130-140	52.217	3.24%
140-150	37.985	2.35%
150-160	23.358	1.45%
160-170	8.999	0.56%
170-180	1.265	0.08%
Total	1613.8	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	716.278	44.38%
60- 90	428.17	26.53%
0-90	1144.45	70.91%
90- 180	469.383	29.09%
0- 180	1613.8	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

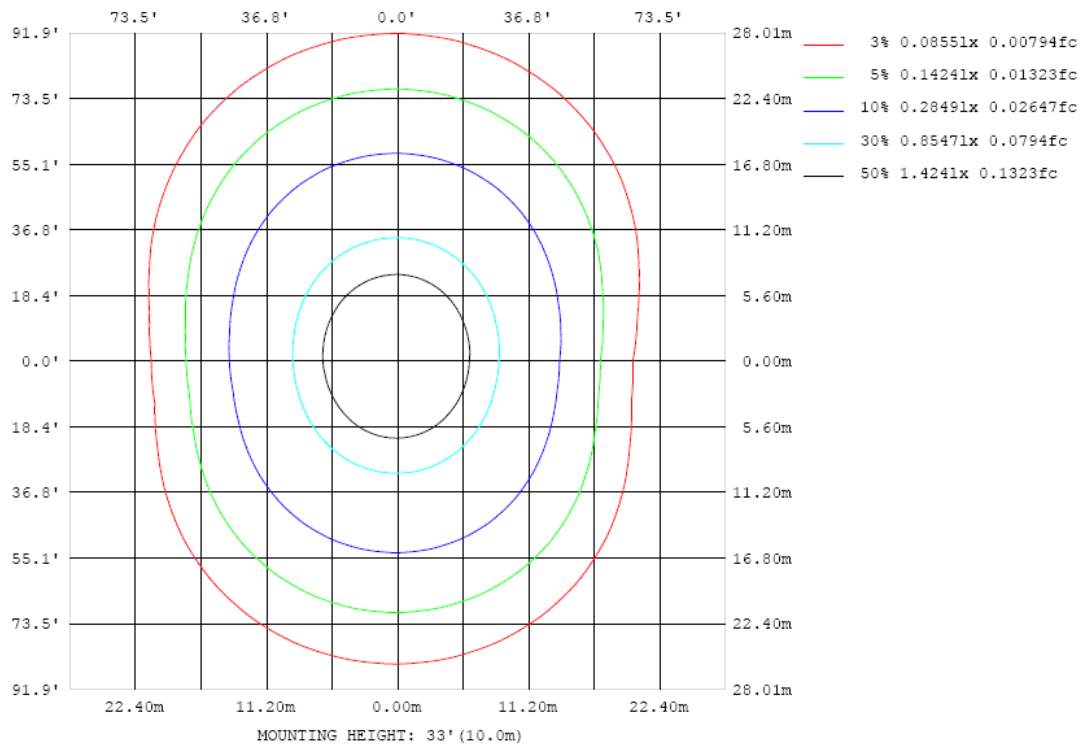


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

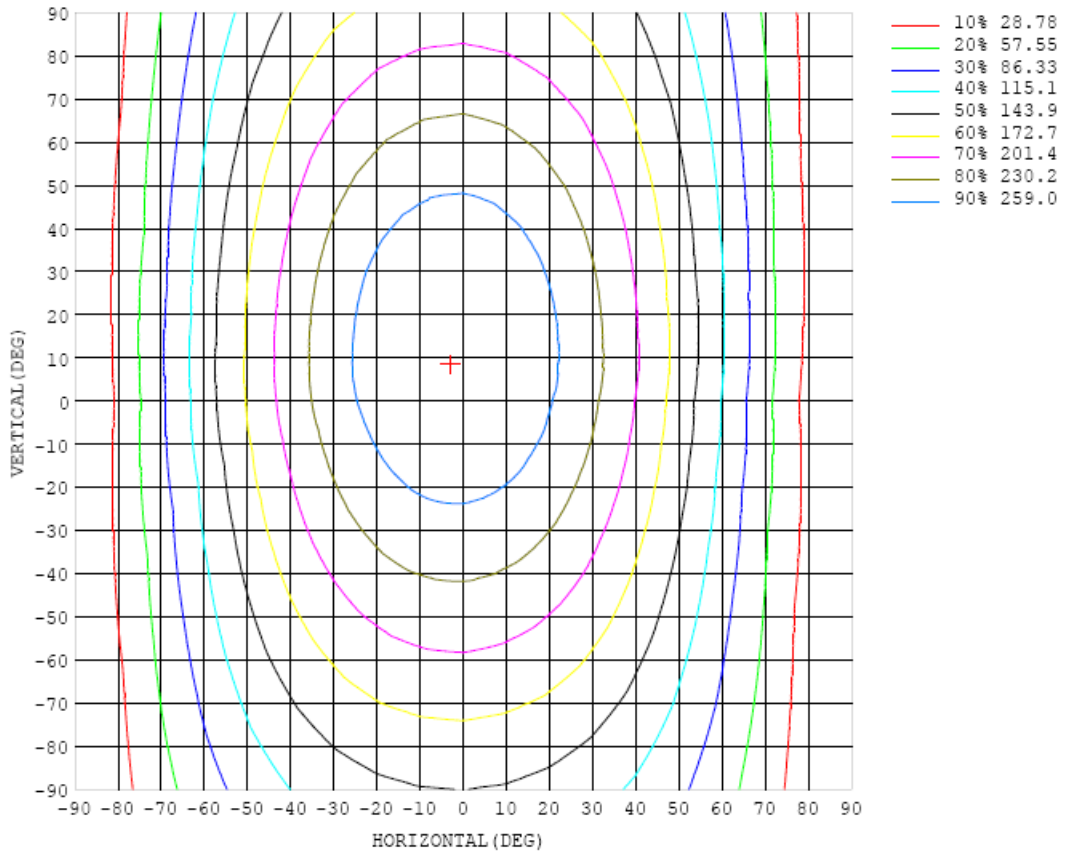


Chart 6: Isocandela Plot

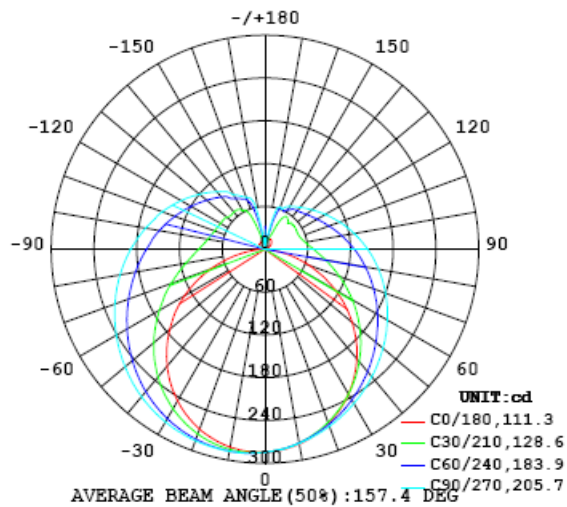


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1 UNIT: cd

C (DEG) \ γ (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	285	285	285	285	285	285	285	285	285	285	285	285	285	285	285	285	285	285	285
5	282	281	281	281	281	281	281	281	281	281	281	282	282	282	283	283	283	283	284
10	277	276	276	276	276	276	276	276	276	276	277	277	278	278	279	279	279	280	282
15	270	269	269	268	268	269	269	270	270	271	271	272	272	272	272	272	273	274	276
20	260	259	259	258	259	260	262	263	263	264	265	265	265	264	265	265	265	266	268
25	248	247	247	247	249	251	253	255	256	257	258	257	257	256	255	254	255	255	258
30	234	233	233	234	237	241	244	246	248	249	250	250	248	246	244	242	242	243	245
35	218	217	218	221	225	230	234	238	240	242	242	241	239	236	233	230	227	228	231
40	200	199	201	206	212	218	224	229	231	233	233	232	229	225	220	215	212	211	214
45	181	180	183	190	198	207	213	219	223	225	224	223	219	213	207	200	194	192	195
50	160	160	165	174	184	195	203	210	214	216	216	213	208	201	193	184	176	172	174
55	137	138	146	158	171	183	193	200	205	207	207	204	198	190	179	168	158	151	154
60	114	116	126	142	157	171	182	191	196	198	198	194	188	178	166	152	139	129	130
65	89.3	92.9	107	126	144	160	172	181	187	189	188	185	177	166	153	136	119	107	106
70	65.6	70.5	89.2	111	132	149	162	172	177	180	179	175	167	155	140	121	101	84.1	81.2
75	41.6	50.4	72.8	97.9	120	139	153	162	168	171	170	165	157	145	128	107	84.0	63.4	56.3
80	20.1	32.5	59.6	86.3	110	129	143	153	159	162	161	156	148	134	117	94.7	69.0	44.0	32.8
85	4.84	19.8	48.7	76.1	100	119	134	144	150	153	152	147	138	125	107	83.7	57.3	28.6	12.5
90	0.25	13.6	41.0	68.5	91.7	111	125	135	142	144	143	138	129	115	97.3	74.3	47.7	19.0	0.96
95	0.23	12.3	36.3	62.1	84.2	103	117	127	133	136	134	129	120	107	88.9	67.1	40.3	12.6	0.82
100	0.18	14.0	34.0	57.1	77.8	95.7	109	119	125	127	126	121	112	99.0	81.8	60.7	35.0	11.4	3.29
105	0.16	16.7	33.6	53.9	72.5	89.2	102	112	117	119	118	113	105	92.0	75.5	55.9	33.1	12.8	5.93
110	1.87	18.6	34.9	51.9	69.3	83.6	95.6	104	109	112	110	106	97.6	85.8	70.7	53.0	33.4	13.9	7.64
115	4.27	25.1	37.1	51.2	66.1	78.8	89.7	97.7	103	104	103	98.8	91.3	80.4	67.7	51.5	34.8	19.1	8.11
120	6.97	30.7	38.2	51.3	63.9	74.8	84.5	91.7	96.1	97.8	96.6	92.5	85.7	76.0	64.8	51.1	35.8	23.0	8.79
125	9.38	27.7	41.5	52.0	62.4	71.5	79.9	86.2	90.0	91.6	90.5	86.9	80.8	72.4	62.9	50.0	36.6	19.4	10.2
130	11.4	19.1	43.0	52.6	61.7	69.8	76.1	81.6	84.9	86.1	85.1	81.9	76.6	70.1	61.7	50.9	39.4	9.71	10.7
135	13.0	14.0	46.3	52.3	61.2	67.9	72.8	77.3	80.0	81.2	80.3	77.6	73.2	68.0	60.8	50.6	43.5	7.96	10.7
140	14.3	9.93	46.3	50.0	59.0	66.4	70.9	73.8	75.8	76.8	76.1	74.0	70.4	66.1	57.6	52.0	45.6	5.32	10.4
145	15.2	7.00	32.1	54.3	54.5	63.0	68.7	70.7	72.4	72.9	72.3	71.4	67.7	62.4	57.8	53.9	30.3	8.16	10.4
150	15.7	9.00	20.6	51.5	57.8	57.5	64.3	66.7	69.3	69.6	69.0	67.0	64.6	60.5	58.1	52.2	13.9	9.78	11.3
155	15.9	7.30	12.2	29.3	56.5	60.5	60.4	60.8	63.2	64.6	64.0	62.2	60.9	60.5	55.8	27.8	8.05	6.65	12.4
160	15.4	5.44	7.76	17.1	30.9	51.8	60.9	62.3	62.7	62.7	62.7	62.4	61.5	49.8	27.6	12.9	9.56	10.7	13.2
165	14.1	6.51	8.05	9.12	14.0	21.5	30.5	43.4	47.9	49.4	48.2	43.6	28.5	13.3	10.3	8.45	8.69	19.4	13.6
170	14.0	18.6	7.50	8.26	11.1	9.47	10.8	12.9	15.5	17.1	16.7	9.98	9.01	8.69	9.79	9.02	13.4	17.1	16.0
175	16.4	26.6	19.5	9.92	12.9	15.0	11.7	8.59	7.66	9.00	8.98	5.54	8.86	11.2	15.6	20.3	17.0	17.4	18.5
180	19.0	18.5	18.9	21.4	24.3	28.0	32.3	33.4	35.2	0.00	0.00	32.2	32.1	32.4	26.1	30.7	30.2	28.9	18.7

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	285	285	285	285	285	285	285	285	285	285	285	285	285	285	285	285	285		
5	285	285	286	286	287	287	287	286	287	287	287	286	286	285	284	283	283		
10	282	284	285	286	287	287	288	288	287	287	287	285	284	283	282	280	279		
15	278	280	281	283	285	286	287	287	286	286	285	284	281	279	277	274	272		
20	270	273	276	278	282	283	285	285	286	284	283	280	277	273	270	266	263		
25	261	264	268	272	276	279	282	283	283	282	279	275	270	265	260	256	253		
30	248	253	258	264	270	274	278	279	279	278	274	269	263	256	250	243	239		
35	235	240	247	254	262	268	272	275	275	273	269	263	254	246	237	230	224		
40	218	225	234	243	253	260	266	269	269	267	262	255	245	234	223	213	207		
45	200	208	219	231	243	252	259	263	264	261	255	246	235	222	208	196	188		
50	179	190	204	218	232	243	251	256	256	253	247	237	224	209	193	178	168		
55	159	172	188	205	221	233	243	247	249	246	238	227	213	195	177	160	147		
60	137	153	171	191	209	224	234	240	241	238	230	218	201	182	161	141	124		
65	114	133	156	178	198	214	225	231	233	229	221	208	190	169	146	121	101		
70	91.0	114	140	164	187	204	216	223	224	220	212	198	180	158	131	103	78.4		
75	68.3	95.4	126	154	176	194	207	213	215	212	203	189	170	147	117	85.9	57.2		
80	47.8	79.4	113	143	166	185	198	205	207	203	194	180	160	136	106	71.8	38.7		
85	31.3	66.5	102	133	158	175	188	195	197	194	185	171	153	127	96.2	61.2	25.7		
90	21.4	57.7	93.2	124	149	167	179	186	189	185	176	163	144	119	88.9	54.2	19.4		
95	18.7	52.5	86.6	116	141	159	170	177	179	176	167	155	137	112	83.2	50.3	17.4		
100	20.3	50.1	81.6	110	133	151	161	168	170	167	160	147	129	107	79.0	48.5	18.8		
105	23.8	49.6	78.0	104	126	143	154	159	161	159	152	140	123	101	76.0	48.5	22.0		
110	28.3	50.3	75.3	98.9	119	135	145	152	154	151	144	132	117	96.8	73.8	49.3	25.9		
115	33.2	51.8	73.5	94.7	113	127	137	143	145	142	136	125	111	92.9	72.4	51.0	30.0		
120	37.7	53.7	72.3	90.7	107	120	129	135	136	134	128	119	105	89.4	71.4	52.6	33.2		
125	41.9	54.4	71.6	87.5	102	113	122	126	128	126	121	112	100	86.4	70.9	54.2	30.7		
130	43.6	56.0	69.7	84.6	96.9	107	114	119	120	118	113	106	95.9	83.9	67.2	55.4	14.4		
135	37.7	57.3	67.3	82.1	92.5	101	107	111	112	111	107	100	91.7	80.0	66.7	56.2	5.70		
140	24.5	57.6	68.0	76.3	88.3	95.7	101	104	105	104	101	95.2	86.6	74.5	67.7	55.7	11.5		
145	11.2	57.6	67.9	74.3	81.1	88.5	94.9	97.7	98.8	97.5	94.5	86.6	79.6	74.3	67.4	46.7	12.0		
150	9.47	49.4	62.0	72.1	77.5	82.0	85.5	87.6	88.2	87.5	85.1	81.3	77.5	73.3	65.4	23.3	8.14		
155	12.9	25.6	57.1	66.0	74.7	78.1	80.3	81.9	82.4	81.8	80.4	78.1	75.5	71.2	55.6	10.8	4.58		
160	8.84	7.94	32.4	54.4	65.3	73.5	76.0	77.4	78.0	77.8	76.7	75.2	72.5	62.4	28.6	14.6	5.86		
165	6.26	13.6	7.61	21.3	40.4	52.5	64.9	70.9	72.2	71.9	69.8	65.7	52.5	28.6	11.1	13.1	8.87		
170	13.1	8.17	13.1	9.17	8.59	13.7	21.0	26.7	30.7	30.1	26.2	16.9	12.0	15.3	13.0	7.83	16.4		
175	18.4	11.0	11.5	13.5	12.5	12.5	12.4	11.1	10.6	13.3	12.3	10.9	10.1	12.2	15.7	16.6	10.6		
180	18.8	18.4	18.3	18.2	17.8	17.8	18.0	18.6	17.9	4.12	5.04	23.0	24.8	25.9	26.9	27.5	27.6		

Table 7: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Jun. 18, 2024	-
Digital Power Meter	PF2010A	HZTE028-01	Aug. 01, 2023	Jul. 31, 2024
AC Power Supply	DPS1060	HZTE001-06	Aug. 01, 2023	Jul. 31, 2024
DC Power Supply	WY12010	HZTE004-03	Aug. 01, 2023	Jul. 31, 2024
Temperature recorder	JM624U	HZTE018-08	Aug. 04, 2023	Aug. 03, 2024
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 04, 2023	Aug. 03, 2024
Standard source	D908	HZTE012-01	Aug. 14, 2018	-
Integrate Sphere system	3M	HZTE015-04	Jun. 18, 2024	-
Digital Power Meter	WT210	HZTE008-01	Aug. 01, 2023	Jul. 31, 2024
AC Power Supply	PCR 500L	HZTE001-07	Aug. 01, 2023	Jul.31, 2024
DC Power Supply	IT6154	HZTE004-04	Aug. 01, 2023	Jul. 31, 2024
Standard source	SCL-1400	HZTE012-06	Nov. 04, 2021	-
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 04, 2023	Aug. 03, 2024
Temperature Meter	TES1310	HZTE017-01	Aug. 04, 2023	Aug. 03, 2024

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 3 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 Tubes) 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 20 min, taken 10 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 Tubes) 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 20 min, taken 10 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.

*** End of Report ***

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