

## LM-79-19 TEST REPORT

for

**Industrial Lighting Products, LLC**

3224 McCraney Loop, Sanford, FL, 32771

**LED Retrofit-kits in Lithonia 2GT8 lensed 2x4**

**Model: ULB3-30L-U-50-L2**

**ULB3-30L-U-50-L2-MWS**

**30LB/3F/850/U/A2**

**30LB/3F/850/U/A2/MWS**

**Laboratory: Leading Testing Laboratories**

**NVLAP CODE: 200960-0**

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Report No.: HZ25030014p

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

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Approved by:



*April Zou*

Engineer: Wei Fei  
May 28, 2025

Manager: April Zou  
May 28, 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: **ULB3-30L-U-50-L2**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
129.5	4179.9	32.27	0.9957
CCT (K)	CRI	Stabilization Time (Light & Power)	
5215	83.9	50	

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>	: Mar. 18, 2025
<b>Date of Test</b>	: Mar. 21, 2025
<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-79-2019 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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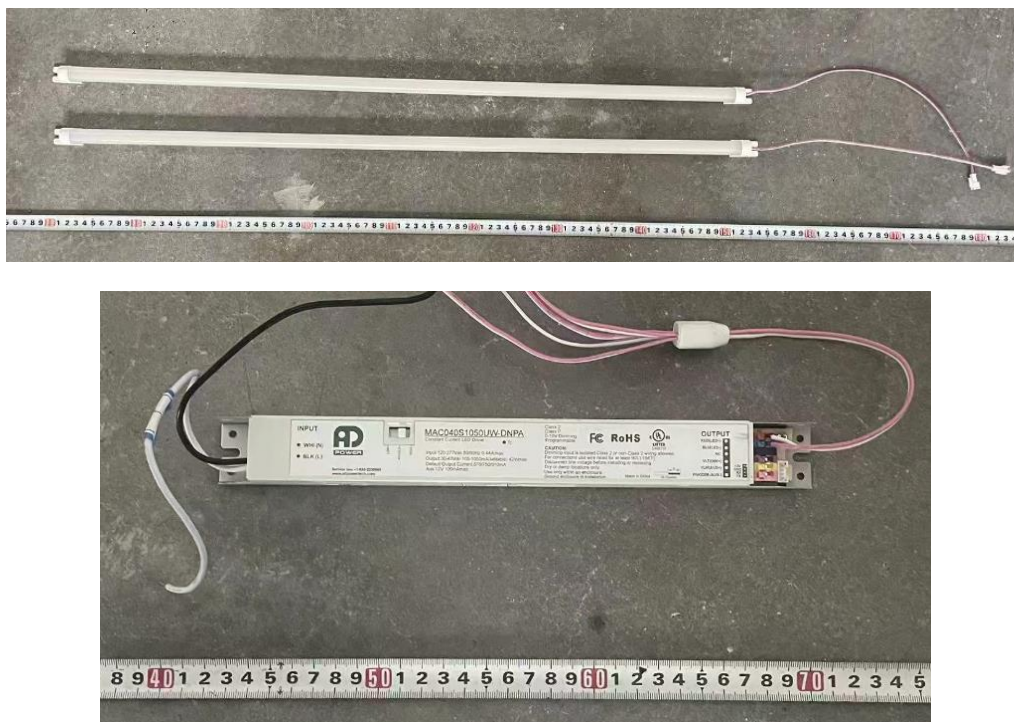


Figure 1- Overview of the sample



Sample in Lithonia 2GT8 lensed 2x4

#### Equipment Under Test(EUT)

<b>Name</b>	: LED Retrofit-kits	
<b>Model</b>	: ULB3-30L-U-50-L2	ULB3-30L-U-50-L2-MWS
	30LB/3F/850/U/A2	30LB/3F/850/U/A2/MWS
<b>Electrical Ratings</b>	: 120-277V, 50/60Hz	
<b>Product Description</b>	: Field-Adjustable 33W/25W/18W, 5000K LED Tube supplied by a LED driver: MAC040S1050UW-DNPA	
<b>Manufacturer</b>	: Industrial Lighting Products, LLC	
<b>Address</b>	: 3224 McCraney Loop, Sanford, FL, 32771	

## 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	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.270	0.122
Power Factor	0.9957	0.9539
Test Power (W)	32.27	32.34
THD A%	6.38	12.78
Luminous Efficacy (lm/W)	129.5	129.6
Total Luminous Flux (lm)	4179.9	4191.3
Color Rendering Index (CRI)	83.9	
R9	16.5	
Correlated Color Temperature (CCT)(K)	5215	
Chromaticity Chroma x	0.3391	
Chromaticity Chroma y	0.3451	
Chromaticity Chroma u	0.2099	
Chromaticity Chroma v	0.3204	
Duv	-0.0008	
Chromaticity Chroma u'	0.2099	
Chromaticity Chroma v'	0.4806	

Special Color Rendering Indices	
R1	83.5
R2	88
R3	90.3
R4	84.9
R5	84
R6	82.6
R7	87.1
R8	71
R9	16.5
R10	70.8
R11	84.9
R12	61.3
R13	84.6
R14	94.7

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)	0.270
Power Factor	0.9953
Power (W)	32.30
Luminous Efficacy (lm/W)	129.7
Total Luminous Flux (lm)	4188.5
Beam Angle ( ° )	95.4 (0°-180°) / 95.9 (90°-270°)
Center Beam Candle Power (cd)	1877
Maximum Beam Candle Power (cd)	1880 (At: C=320.0, Gamma=0.5)
Spacing Criteria	1.20 (0°-180°) / 1.25 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	88.23%
Zonal Lumens in the 60 °-90 °Zone	11.52%
Zonal Lumens in the 90 °-120 °Zone	0.09%
Zonal Lumens in the 120 °-180 °Zone	0.15%

Table 3: Test data per Goniophotometer Method

### Spectral Power Distribution - Sphere Spectroradiometer Method

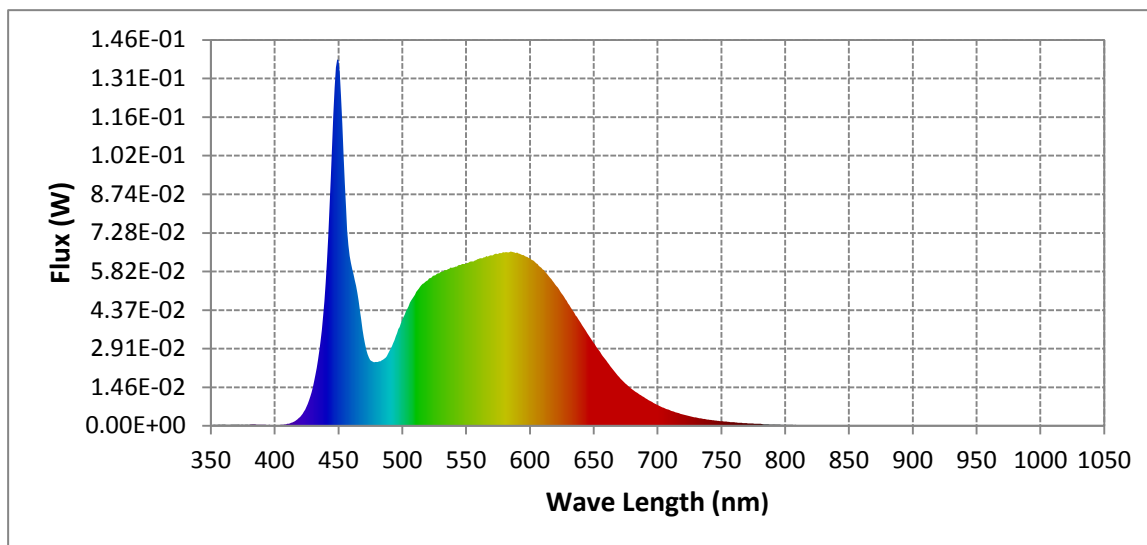


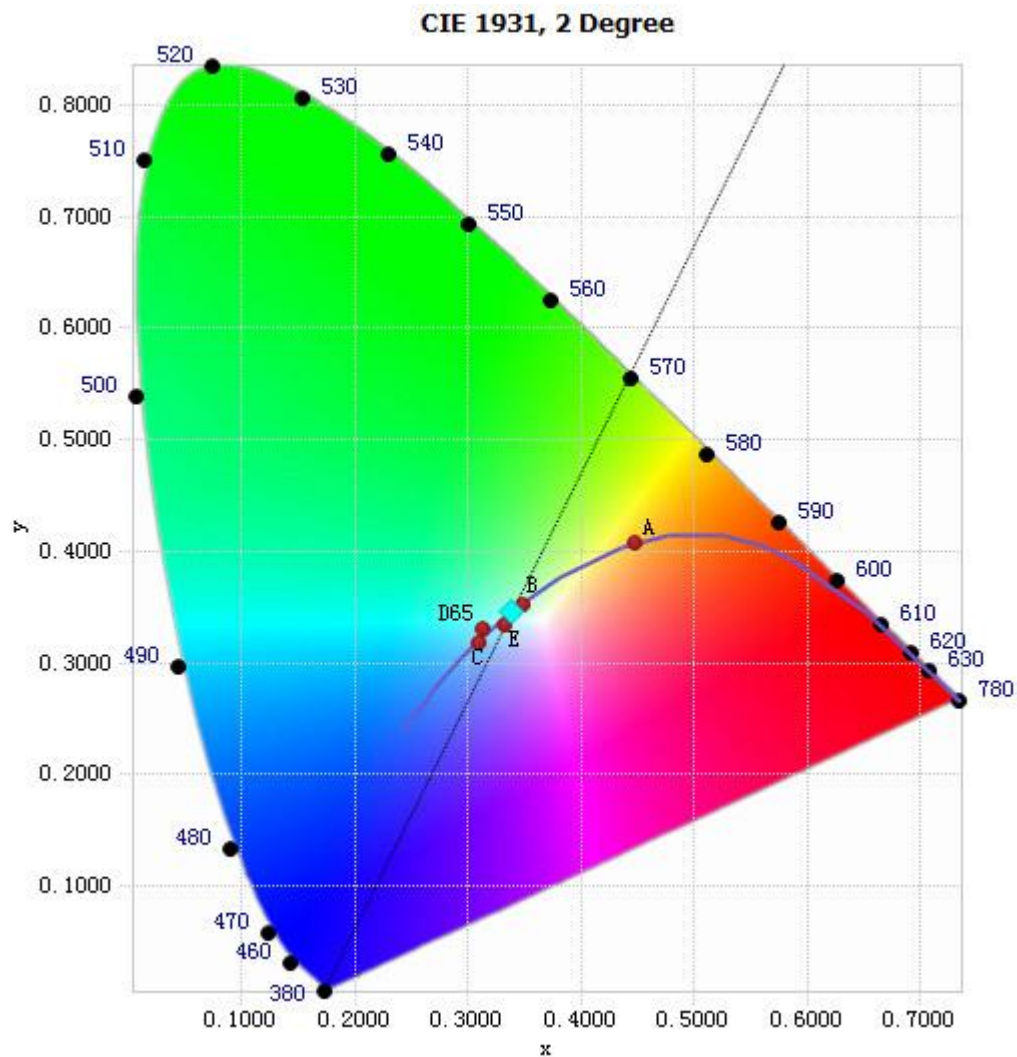
Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	4.80E-04	485	2.49E-02	590	6.54E-02	695	9.20E-03
385	5.04E-04	490	2.81E-02	595	6.44E-02	700	7.93E-03
390	4.01E-04	495	3.37E-02	600	6.32E-02	705	6.80E-03
395	3.23E-04	500	3.99E-02	605	6.13E-02	710	5.80E-03
400	2.87E-04	505	4.51E-02	610	5.90E-02	715	5.03E-03
405	3.85E-04	510	4.94E-02	615	5.64E-02	720	4.30E-03
410	7.27E-04	515	5.31E-02	620	5.33E-02	725	3.70E-03
415	1.54E-03	520	5.49E-02	625	4.99E-02	730	3.17E-03
420	3.33E-03	525	5.66E-02	630	4.62E-02	735	2.72E-03
425	7.16E-03	530	5.80E-02	635	4.25E-02	740	2.33E-03
430	1.46E-02	535	5.87E-02	640	3.88E-02	745	2.01E-03
435	2.82E-02	540	5.97E-02	645	3.49E-02	750	1.74E-03
440	5.39E-02	545	6.07E-02	650	3.13E-02	755	1.52E-03
445	1.05E-01	550	6.11E-02	655	2.79E-02	760	1.34E-03
450	1.38E-01	555	6.20E-02	660	2.45E-02	765	1.15E-03
455	9.11E-02	560	6.29E-02	665	2.13E-02	770	9.93E-04
460	6.14E-02	565	6.35E-02	670	1.84E-02	775	8.58E-04
465	5.02E-02	570	6.42E-02	675	1.59E-02	780	7.58E-04
470	3.34E-02	575	6.48E-02	680	1.38E-02		
475	2.48E-02	580	6.54E-02	685	1.21E-02		
480	2.40E-02	585	6.57E-02	690	1.06E-02		

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



## Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3391, 0.3451)

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

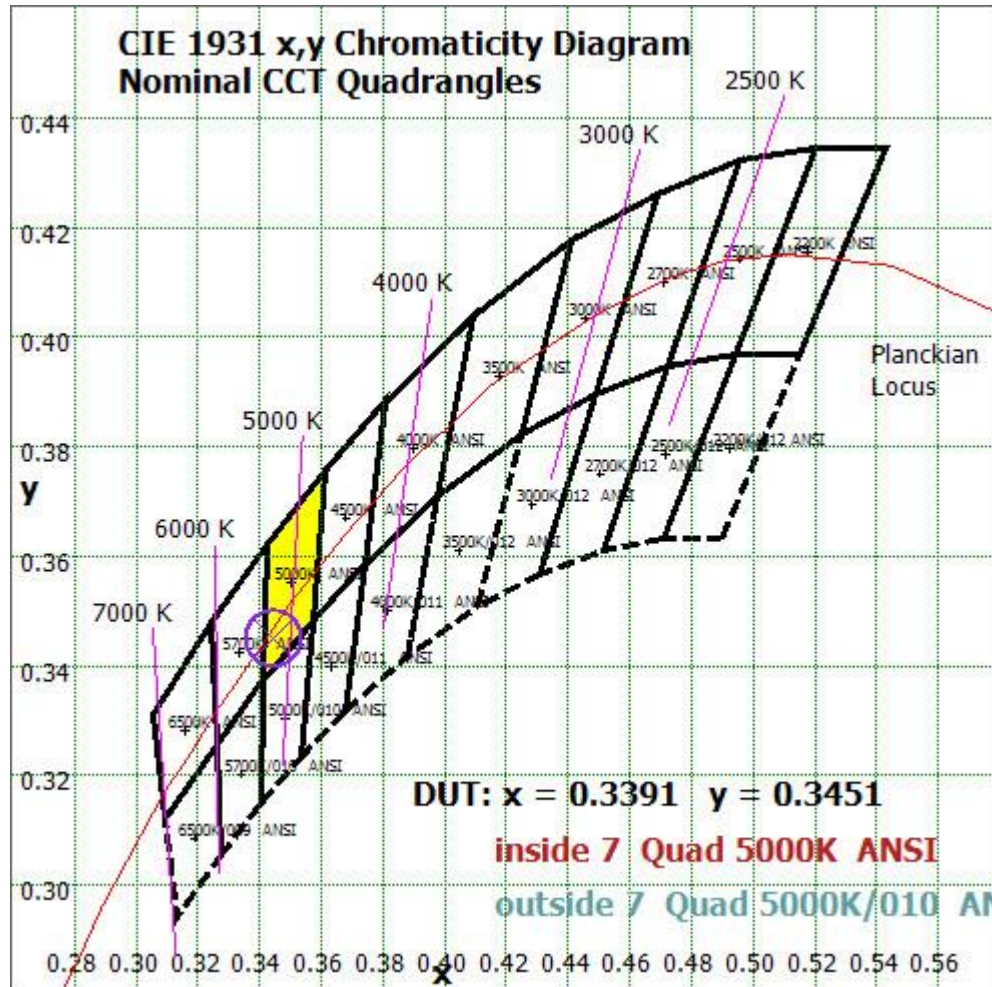


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram



Quality Assured  
Color Rendition Report – Sphere Spectroradiometer Method

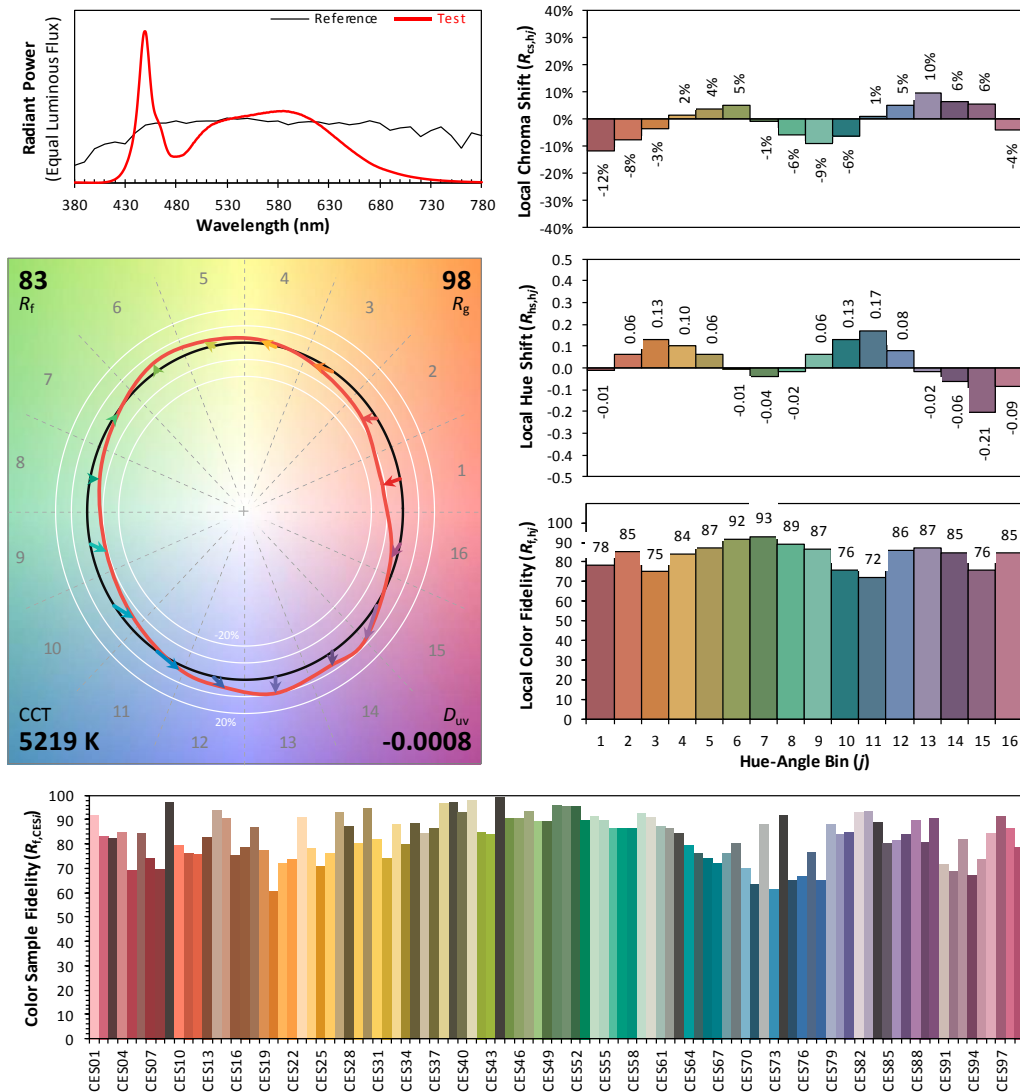
## ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: Industrial Lighting Products, LLC

Date: 2025/03/21

Model: ULB3-30L-U-50-L2



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

$x$  0.3391  
 $y$  0.3451  
 $u'$  0.2099  
 $v'$  0.4806

CIE 13.3-1995  
(CRI)

$R_a$  84  
 $R_g$  16

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	177.445	4.24%
10- 20	507.519	12.12%
20- 30	764.278	18.25%
30- 40	901.864	21.53%
40- 50	832.432	19.87%
50- 60	512.151	12.23%
60- 70	274.217	6.55%
70- 80	153.284	3.66%
80- 90	55.156	1.32%
90-100	0.918	0.02%
100-110	1.692	0.04%
110-120	1.266	0.03%
120-130	1.392	0.03%
130-140	1.547	0.04%
140-150	1.43	0.03%
150-160	1.075	0.03%
160-170	0.652	0.02%
170-180	0.183	0.00%
Total	4188.5	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	3695.689	88.23%
60- 90	482.657	11.52%
0-90	4178.346	99.76%
90- 180	10.155	0.24%
0- 180	4188.5	100%

Table 5: Zonal Lumen

### Illuminance Plots- Goniophotometer Method

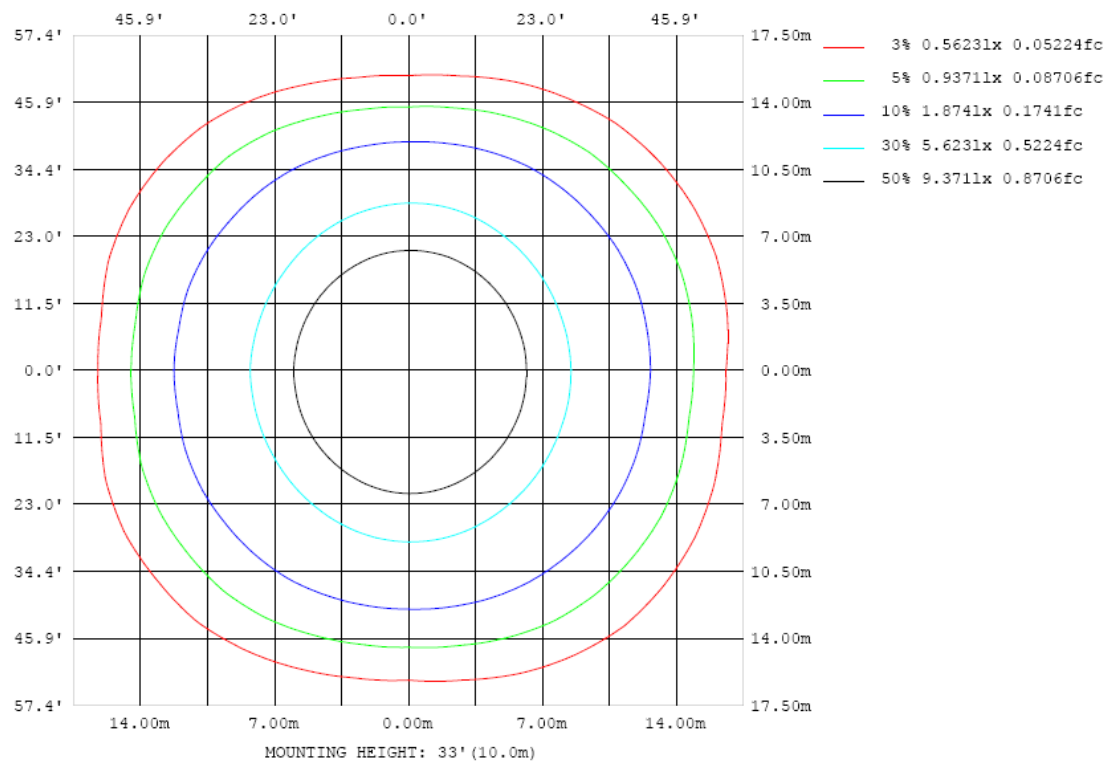


Chart 5: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

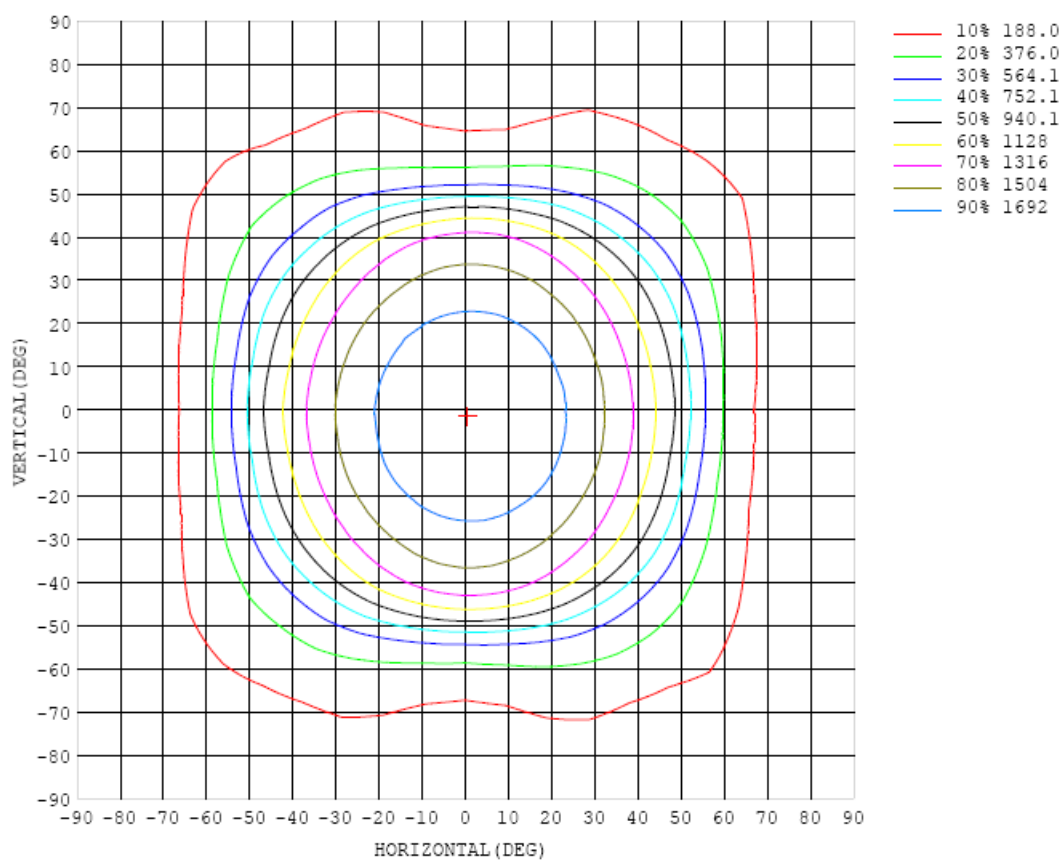


Chart 6: Isocandela Plot

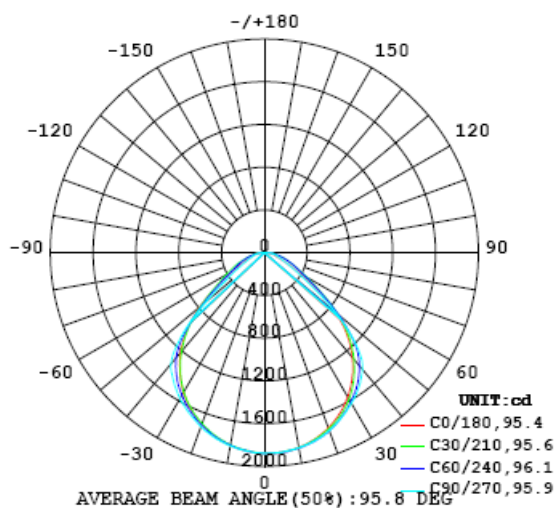


Chart 7: Polar Candela Distribution

## 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	1877	1877	1877	1877	1877	1877	1877	1877	1877	1877	1877	1877	1877	1877	1877	1877	1877	1877	1877
5	1879	1875	1873	1874	1876	1879	1876	1879	1874	1874	1870	1871	1868	1864	1872	1859	1865	1861	1868
10	1851	1853	1852	1850	1853	1858	1859	1854	1854	1854	1850	1846	1839	1840	1841	1833	1834	1829	1832
15	1810	1808	1810	1816	1818	1821	1822	1829	1824	1823	1817	1814	1806	1802	1796	1785	1783	1776	1782
20	1746	1750	1751	1756	1763	1773	1774	1774	1775	1772	1766	1761	1752	1743	1740	1719	1717	1707	1712
25	1664	1665	1671	1681	1691	1697	1704	1703	1704	1704	1697	1687	1674	1666	1654	1640	1630	1617	1619
30	1559	1565	1573	1584	1591	1603	1612	1626	1629	1627	1617	1604	1586	1567	1555	1531	1521	1507	1513
35	1431	1440	1446	1455	1473	1493	1515	1526	1536	1538	1527	1508	1479	1450	1424	1396	1385	1373	1373
40	1281	1284	1287	1302	1327	1353	1381	1408	1422	1425	1406	1376	1337	1302	1268	1235	1218	1205	1218
45	1097	1092	1100	1122	1144	1167	1188	1203	1209	1208	1190	1168	1143	1104	1072	1043	1024	1006	1022
50	872	855	879	895	900	903	907	894	877	863	859	858	862	846	829	819	806	771	783
55	601	593	626	648	648	644	628	592	549	527	537	562	594	606	598	594	576	531	530
60	365	372	418	449	462	467	439	404	359	333	347	379	409	434	429	427	401	347	334
65	225	236	290	329	333	331	326	297	245	222	235	272	306	308	307	316	292	235	212
70	145	158	210	245	230	233	245	217	173	156	171	204	232	228	219	234	218	163	143
75	107	116	159	180	159	158	175	161	131	121	127	158	172	156	159	165	166	130	117
80	83.4	93.1	123	121	104	101	117	116	101	94.9	98.2	114	116	103	96.8	112	119	106	86.2
85	51.7	59.4	70.1	68.0	58.1	56.5	61.7	64.2	57.7	55.0	57.6	61.9	59.2	53.8	48.1	58.4	63.1	56.4	49.2
90	2.38	5.73	2.45	2.66	5.76	4.11	3.33	2.91	2.35	3.78	4.03	2.14	2.23	2.30	2.17	2.34	1.78	2.69	0.44
95	0.49	0.52	0.69	0.72	0.48	0.41	0.36	0.28	0.22	0.21	0.22	0.23	0.28	0.31	0.40	0.53	0.76	0.74	0.56
100	0.48	0.48	0.56	1.95	2.07	2.21	2.02	1.63	1.46	1.39	1.53	1.64	1.53	1.09	1.06	0.98	0.74	0.78	0.91
105	0.77	0.84	0.76	0.89	1.36	2.38	2.45	2.25	2.30	2.20	2.22	2.35	2.13	1.41	1.09	0.78	0.91	0.90	1.11
110	1.01	1.37	0.98	1.11	1.07	1.12	1.35	1.79	1.82	2.13	2.06	1.62	1.09	0.85	0.95	0.89	1.10	1.19	1.17
115	1.25	1.84	1.28	1.26	1.30	1.19	1.19	1.08	1.01	0.98	0.95	0.89	0.93	0.93	1.07	1.00	1.30	1.26	1.41
120	1.69	2.12	1.27	1.48	1.46	1.26	1.24	1.13	1.12	1.09	1.08	1.05	1.06	1.09	1.28	1.13	1.54	2.05	1.45
125	1.98	2.17	1.60	1.72	1.92	1.51	1.33	1.22	1.19	1.21	1.19	1.16	1.19	1.35	1.55	1.33	1.33	2.24	1.71
130	1.12	1.40	2.46	1.40	2.27	1.79	1.75	1.39	1.33	1.31	1.32	1.36	1.41	1.54	1.80	1.61	1.44	1.78	1.71
135	1.60	2.78	3.32	1.07	2.51	2.35	2.00	1.59	1.49	1.43	1.48	1.50	1.76	1.80	2.04	1.13	1.67	2.12	1.69
140	1.59	2.95	3.25	3.29	1.18	2.55	2.20	1.92	1.87	1.69	1.79	1.68	1.86	2.08	1.39	1.58	2.21	2.23	1.31
145	1.34	2.65	3.16	3.69	2.77	1.24	2.30	2.39	1.96	1.96	1.84	2.03	2.03	1.29	1.39	2.21	2.42	2.34	1.36
150	1.42	2.76	3.14	3.53	3.99	2.41	1.32	1.26	1.72	1.70	1.74	1.38	1.32	1.38	2.26	2.56	2.48	2.22	1.51
155	1.54	2.36	3.10	3.43	2.82	2.35	3.32	2.52	1.67	1.36	1.39	1.69	1.82	1.94	1.91	2.11	2.42	2.06	1.55
160	1.41	1.59	2.03	2.24	2.58	3.43	3.58	3.43	3.15	2.78	2.78	2.68	2.13	2.31	2.44	2.12	1.89	1.75	1.40
165	1.47	1.54	2.17	2.55	2.78	2.82	2.94	2.96	2.80	2.65	2.40	2.38	2.41	2.19	2.09	1.86	1.71	1.72	1.45
170	1.59	1.65	1.82	2.25	2.36	2.41	2.47	2.42	2.36	2.28	2.22	2.18	1.89	1.82	1.80	1.82	1.84	1.73	1.52
175	1.75	1.82	1.84	1.87	1.98	2.01	2.00	2.07	2.07	2.07	1.89	1.69	1.80	2.11	2.08	2.00	1.87	1.80	1.71
180	1.73	1.75	1.77	1.78	1.79	1.81	1.77	1.79	1.48	1.60	1.73	1.68	1.69	1.73	1.69	1.72	1.74	1.70	1.72

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		1877	1877	1877	1877	1877	1877	1877	1877	1877	1877	1877	1877	1877	1877	1877	1877	1877		
5		1864	1861	1858	1863	1869	1868	1864	1864	1864	1862	1862	1863	1866	1875	1866	1873	1871		
10		1828	1826	1826	1825	1827	1826	1834	1831	1835	1835	1838	1836	1839	1844	1840	1848	1848		
15		1778	1774	1775	1778	1784	1786	1785	1790	1794	1793	1796	1798	1798	1800	1799	1803	1804		
20		1705	1701	1701	1705	1714	1721	1727	1729	1732	1735	1736	1735	1739	1745	1733	1740	1741		
25		1614	1612	1614	1624	1631	1635	1644	1653	1660	1659	1663	1660	1657	1659	1656	1658	1659		
30		1504	1501	1508	1515	1530	1543	1557	1568	1575	1579	1577	1572	1568	1564	1552	1556	1555		
35		1364	1362	1367	1382	1401	1423	1445	1464	1478	1477	1473	1460	1449	1439	1425	1424	1428		
40		1196	1194	1203	1218	1250	1285	1316	1343	1359	1359	1346	1323	1302	1285	1273	1267	1269		
45		1000	1004	1010	1016	1028	1044	1050	1061	1086	1095	1102	1111	1101	1093	1081	1083	1082		
50		766	780	774	760	758	748	724	705	707	729	766	804	825	841	861	869	862		
55		526	553	556	540	538	509	464	425	414	437	481	529	570	591	616	630	616		
60		344	388	407	400	385	353	318	282	267	283	330	367	401	424	432	430	402		
65		231	283	311	277	269	269	239	200	181	190	234	282	294	302	319	312	267		
70		161	209	224	195	193	207	188	152	130	137	172	211	216	209	224	232	177		
75		124	162	154	142	129	148	143	114	103	106	129	155	147	144	158	172	129		
80		95.8	115	99.6	85.1	79.0	91.7	94.4	84.7	77.0	79.0	90.5	102	93.0	83.5	108	124	103		
85		53.1	59.0	50.0	39.2	36.2	39.7	42.6	40.9	38.0	39.6	46.5	49.3	47.8	47.2	62.1	64.0	62.6		
90		1.40	5.75	0.50	0.72	0.49	0.33	0.23	0.18	0.17	0.18	0.20	0.23	0.27	0.51	0.91	0.91	0.70		
95		0.99	1.02	0.89	1.18	0.86	0.63	0.51	0.43	0.40	0.37	0.36	0.41	0.46	0.52	0.60	0.69	0.73		
100		1.54	1.59	0.90	1.58	1.37	1.18	1.16	1.66	1.92	1.98	2.04	2.05	1.59	1.81	1.76	0.60	0.53		
105		1.55	2.30	1.02	1.23	1.33	2.04	2.42	2.54	2.65	2.77	2.89	3.03	2.83	2.01	0.97	0.76	0.88		
110		1.73	1.44	0.98	1.35	1.14	1.37	1.72	2.04	2.28	2.33	2.13	1.81	1.27	1.15	1.25	0.87	1.19		
115		1.69	1.50	1.07	1.36	1.21	1.10	1.06	1.09	1.12	1.11	1.12	1.22	1.23	1.43	1.48	1.06	1.86		
120		1.78	1.50	1.22	1.53	1.35	1.20	1.18	1.18	1.19	1.20	1.25	1.28	1.43	1.69	1.70	1.26	2.40		
125		2.01	1.80	1.45	1.69	1.70	1.52	1.37	1.34	1.35	1.34	1.39	1.52	1.78	2.00	2.10	0.97	2.23		
130		1.80	1.97	1.40	2.06	1.93	1.81	1.73	1.64	1.60	1.63	1.73	1.78	2.00	2.48	2.41	2.50	1.54		
135		2.18	1.86	1.24	2.03	2.31	2.17	1.85	1.92	1.83	1.85	2.02	2.22	2.48	3.01	1.20	3.43	2.97		
140		2.07	2.28	2.10	1.43	2.42	2.41	2.29	2.21	2.13	2.19	2.57	2.54	3.26	1.75	2.93	3.69	3.14		
145		2.24	2.42	2.54	2.07	1.56	2.25	2.67	2.62	2.88	2.77	2.68	2.70	1.80	1.96	3.51	3.13	2.81		
150		2.18	2.42	2.55	2.49	2.16	1.63	1.89	1.90	2.00	1.80	1.94	1.45	1.86	3.83	3.65	2.99	2.76		
155		2.09	2.28	2.41	2.34	2.34	2.21	2.19	1.90	1.69	1.86	2.69	3.45	2.73	2.33	3.08	3.04	2.81		
160		1.71	1.87	2.00	2.10	2.48	2.45	2.38	2.78	3.15	3.35	3.43	3.68	3.42	2.82	2.29	2.05	1.92		
165		1.50	1.70	1.74	1.86	2.12	2.37	2.38	2.54	2.56	2.74	2.80	2.81	2.83	2.69	2.39	2.30	1.97		
170		1.53	1.68	1.81	1.80	1.73	1.81	1.94	2.23	2.16	2.23	2.32	2.25	2.26	2.07	2.15	2.11	1.84		
175		1.71	1.76	1.91	2.04	2.09	2.07	1.83	1.69	1.70	1.91	1.91	1.94	1.87	1.91	1.95	1.86	1.74		
180		1.72	1.75	1.76	1.77	1.77	1.78	1.76	1.75	1.62	1.58	1.60	1.73	1.74	1.76	1.75	1.74	1.75		

Table 7: Luminous Intensity Data

## EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Feb. 05, 2025	-
Digital Power Meter	PF2010A	HZTE028-01	Aug. 08, 2024	Aug. 07, 2025
AC Power Supply	DPS1060	HZTE001-06	Aug. 08, 2024	Aug. 07, 2025
DC Power Supply	WY12010	HZTE004-03	Aug. 08, 2024	Aug. 07, 2025
Temperature recorder	JM624U	HZTE018-08	Aug. 08, 2024	Aug. 07, 2025
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 08, 2024	Aug. 07, 2025
Standard source	D908	HZTE012-01	Aug. 14, 2018	-
Integrate Sphere system	3M	HZTE015-04	Dec. 10, 2024	-
Digital Power Meter	WT210	HZTE008-01	Aug. 08, 2024	Aug. 07, 2025
AC Power Supply	PCR 500L	HZTE001-07	Aug. 08, 2024	Aug. 07, 2025
DC Power Supply	IT6154	HZTE004-04	Aug. 08, 2024	Aug. 07, 2025
Standard source	SCL-1400	HZTE012-06	Nov. 04, 2021	-
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 08, 2024	Aug. 07, 2025
Temperature Meter	TES1310	HZTE017-01	Aug. 08, 2024	Aug. 07, 2025

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  $4\pi$ . 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 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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