



## 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: ULB4-40L-U-50-L2**

**ULB4-40L-U-50-L2-MWS**

**40LB/4F/850/U/A2**

**40LB/4F/850/U/A2/MWS**

**Laboratory: Leading Testing Laboratories**

**NVLAP CODE: 200960-0**

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Report No.: HZ25030014y

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

Review by:

*Wei Fei*

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: **ULB4-40L-U-50-L2**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
127.7	5044.4	39.50	0.9959
CCT (K)	CRI	Stabilization Time (Light & Power)	
5205	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. 27, 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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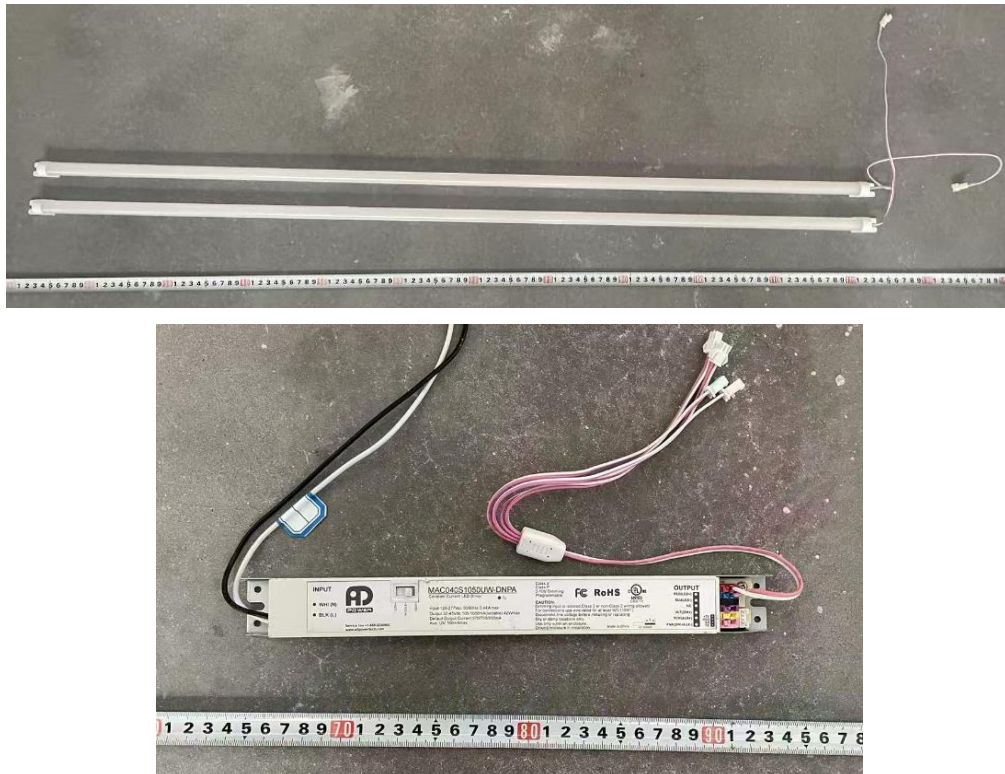


Figure 1- Overview of the sample



Sample in Lithonia 2GT8 lensed 2x4

#### Equipment Under Test(EUT)

<b>Name</b>	: LED Retrofit-kits	
<b>Model</b>	: ULB4-40L-U-50-L2	ULB4-40L-U-50-L2-MWS
	40LB/4F/850/U/A2	40LB/4F/850/U/A2/MWS
<b>Electrical Ratings</b>	: 120-277V, 50/60Hz	
<b>Product Description</b>	: Field-Adjustable 40W/36W/32W, 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)	0.331	0.147
Power Factor	0.9959	0.9618
Test Power (W)	39.50	39.21
THD A%	7.03	15.06
Luminous Efficacy (lm/W)	127.7	129.1
Total Luminous Flux (lm)	5044.4	5063.9
Color Rendering Index (CRI)	83.9	
R9	16.4	
Correlated Color Temperature (CCT)(K)	5205	
Chromaticity Chroma x	0.3394	
Chromaticity Chroma y	0.3450	
Chromaticity Chroma u	0.2101	
Chromaticity Chroma v	0.3204	
Duv	-0.0010	
Chromaticity Chroma u'	0.2101	
Chromaticity Chroma v'	0.4806	

Special Color Rendering Indices	
R1	83.4
R2	88.1
R3	90.4
R4	84.8
R5	84
R6	82.6
R7	87.1
R8	70.8
R9	16.4
R10	71.1
R11	84.7
R12	61.2
R13	84.6
R14	94.8

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)	0.331
Power Factor	0.9960
Power (W)	39.51
Luminous Efficacy (lm/W)	128.0
Total Luminous Flux (lm)	5055.7
Beam Angle ( ° )	93.6 (0°-180°) / 94.1 (90°-270°)
Center Beam Candle Power (cd)	2301
Maximum Beam Candle Power (cd)	2307 (At: C=70.0, Gamma=2.5)
Spacing Criteria	1.20 (0°-180°) / 1.25 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	88.47%
Zonal Lumens in the 60 °-90 °Zone	11.27%
Zonal Lumens in the 90 °-120 °Zone	0.09%
Zonal Lumens in the 120 °-180 °Zone	0.18%

Table 3: Test data per Goniophotometer Method

### Spectral Power Distribution - Sphere Spectroradiometer Method

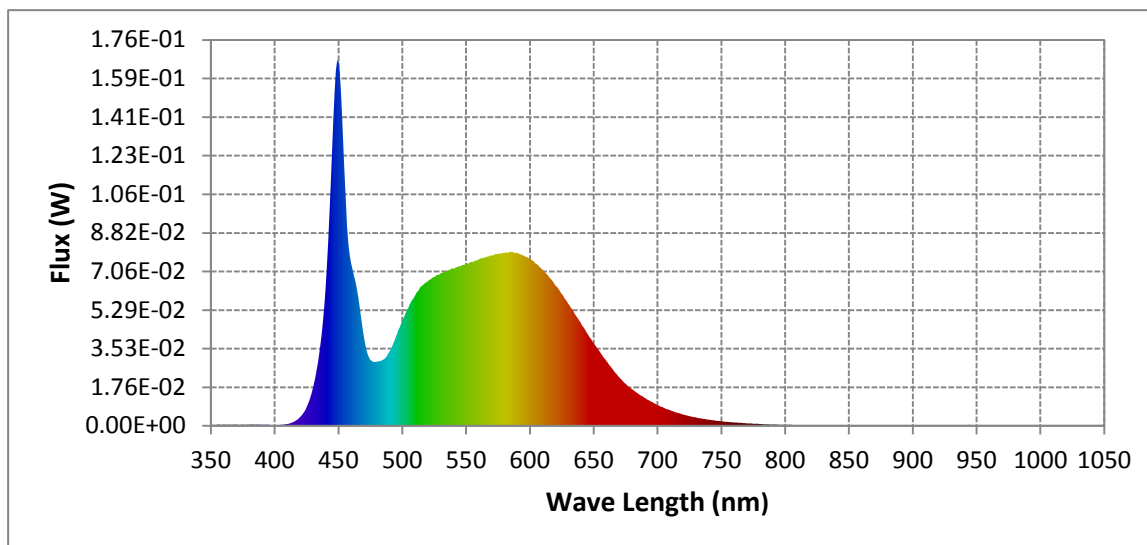


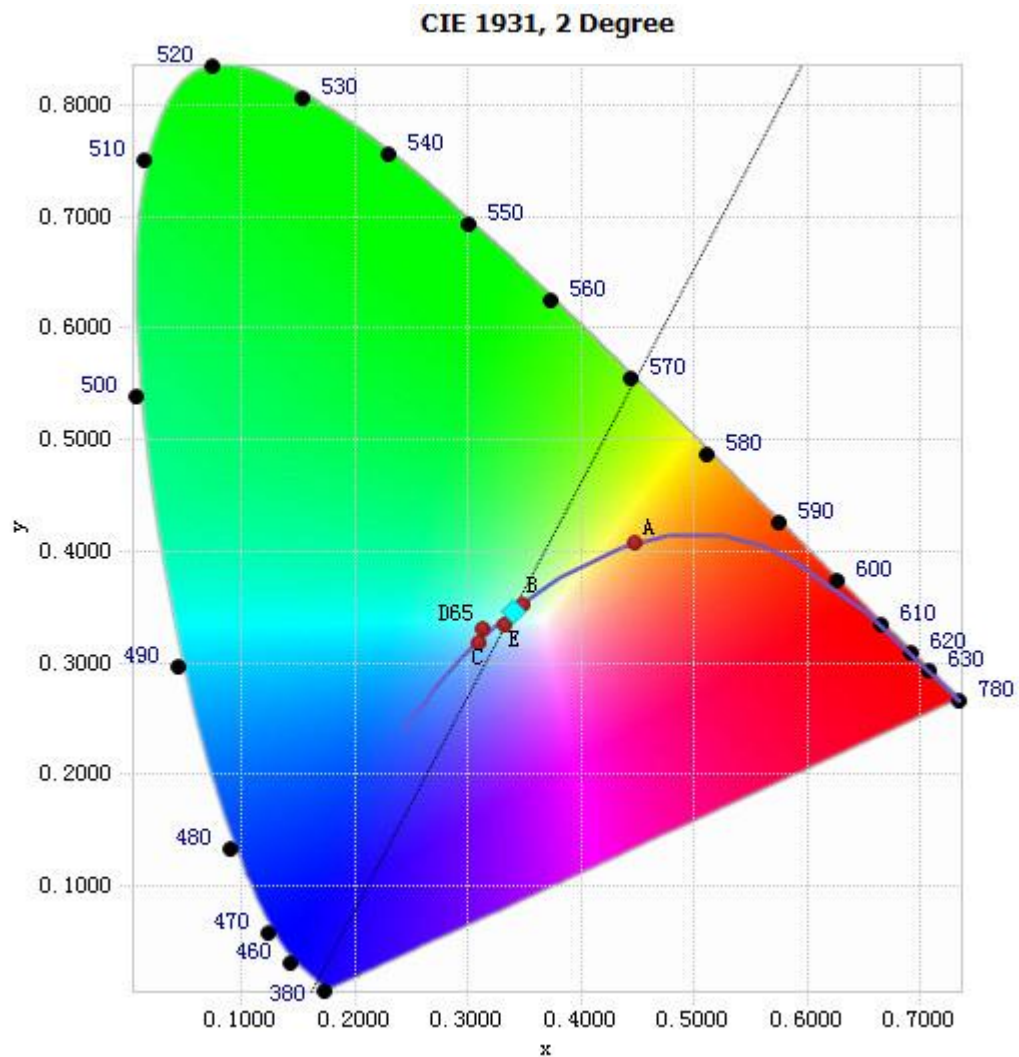
Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	6.21E-04	485	3.02E-02	590	7.91E-02	695	1.11E-02
385	5.31E-04	490	3.39E-02	595	7.79E-02	700	9.58E-03
390	5.73E-04	495	4.07E-02	600	7.64E-02	705	8.23E-03
395	5.06E-04	500	4.78E-02	605	7.39E-02	710	7.06E-03
400	4.21E-04	505	5.43E-02	610	7.12E-02	715	6.03E-03
405	4.67E-04	510	5.94E-02	615	6.83E-02	720	5.21E-03
410	7.99E-04	515	6.37E-02	620	6.42E-02	725	4.45E-03
415	1.78E-03	520	6.60E-02	625	6.03E-02	730	3.84E-03
420	3.96E-03	525	6.81E-02	630	5.59E-02	735	3.27E-03
425	8.38E-03	530	6.97E-02	635	5.14E-02	740	2.80E-03
430	1.71E-02	535	7.06E-02	640	4.70E-02	745	2.40E-03
435	3.31E-02	540	7.19E-02	645	4.23E-02	750	2.08E-03
440	6.35E-02	545	7.30E-02	650	3.78E-02	755	1.82E-03
445	1.26E-01	550	7.36E-02	655	3.37E-02	760	1.55E-03
450	1.67E-01	555	7.48E-02	660	2.96E-02	765	1.33E-03
455	1.12E-01	560	7.60E-02	665	2.58E-02	770	1.16E-03
460	7.47E-02	565	7.69E-02	670	2.21E-02	775	1.01E-03
465	6.12E-02	570	7.78E-02	675	1.92E-02	780	8.54E-04
470	4.11E-02	575	7.84E-02	680	1.67E-02		
475	3.01E-02	580	7.90E-02	685	1.46E-02		
480	2.93E-02	585	7.96E-02	690	1.29E-02		

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



## Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3394, 0.3450)

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

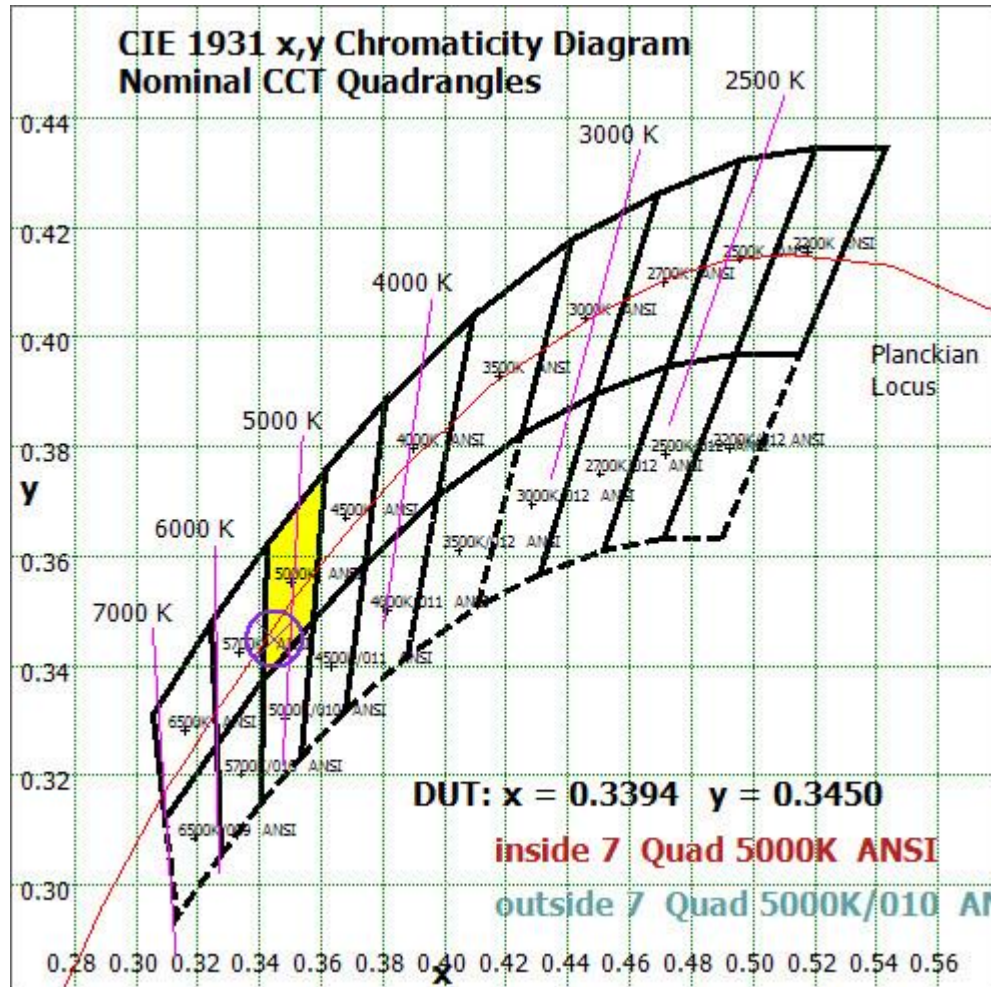
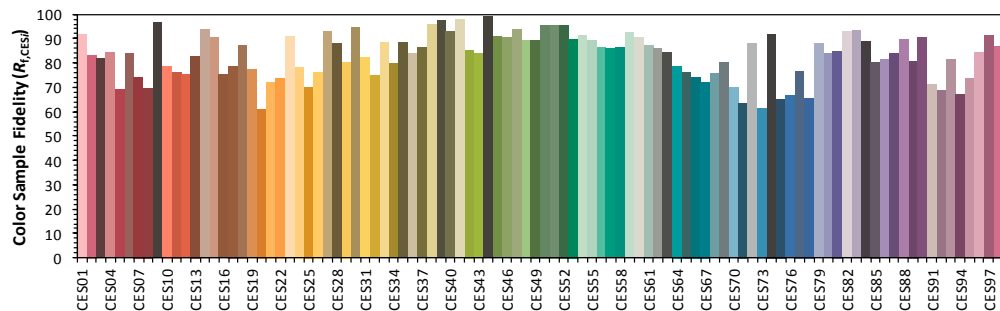
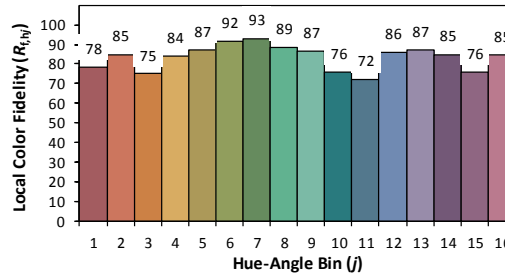
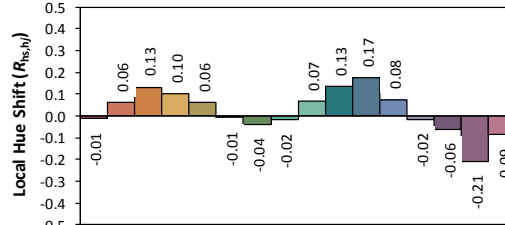
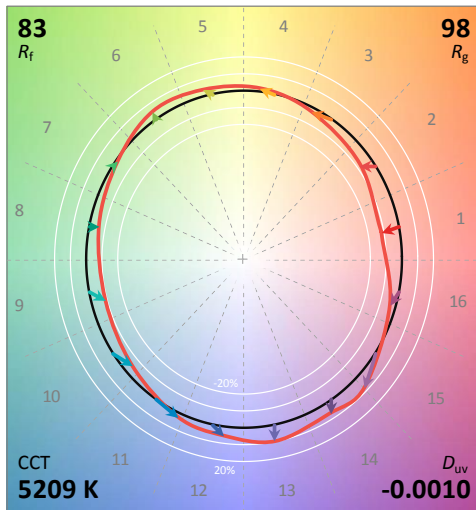
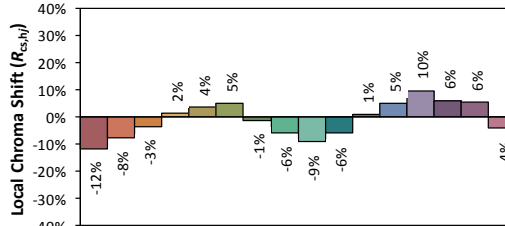
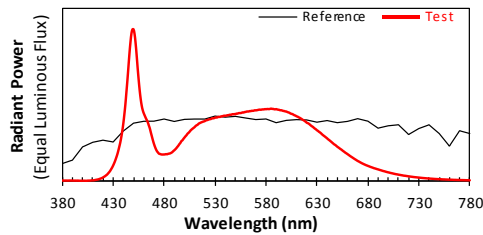


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

**Color Rendition Report – Sphere Spectroradiometer Method****ANSI/IES TM-30-18 Color Rendition Report****Source:** LED**Manufacturer:** Industrial Lighting Products, LLC**Date:** 2025/03/27**Model:** ULB4-40L-U-50-L2

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

$x$  0.3394  
 $y$  0.3450  
 $u'$  0.2101  
 $v'$  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	217.366	4.30%
10- 20	621.236	12.29%
20- 30	938.265	18.56%
30- 40	1106.087	21.88%
40- 50	990.534	19.59%
50- 60	599.098	11.85%
60- 70	323.742	6.40%
70- 80	182.216	3.60%
80- 90	63.796	1.26%
90-100	1.304	0.03%
100-110	1.567	0.03%
110-120	1.625	0.03%
120-130	1.996	0.04%
130-140	2.329	0.05%
140-150	2.073	0.04%
150-160	1.394	0.03%
160-170	0.828	0.02%
170-180	0.239	0.00%
Total	5055.7	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	4472.586	88.47%
60- 90	569.754	11.27%
0-90	5042.34	99.74%
90- 180	13.355	0.26%
0- 180	5055.7	100%

Table 5: Zonal Lumen

### Illuminance Plots- Goniophotometer Method

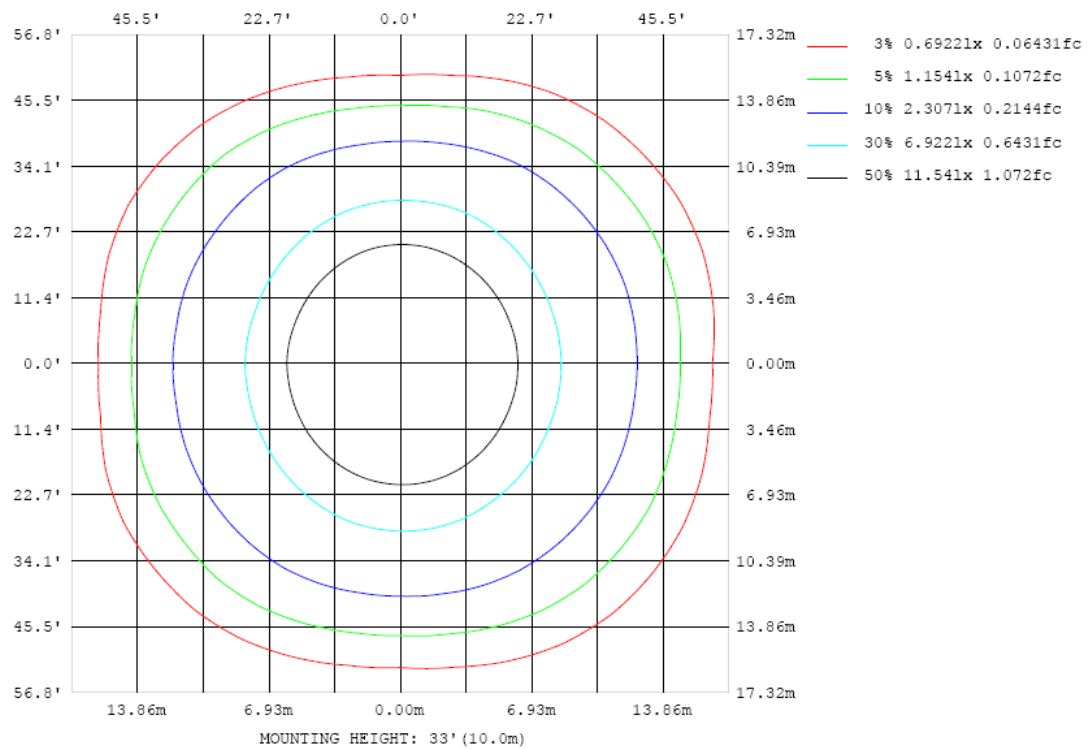


Chart 5: Illuminance Plot (Footcandles)

### Luminous Intensity Distribution Plots- Goniophotometer Method

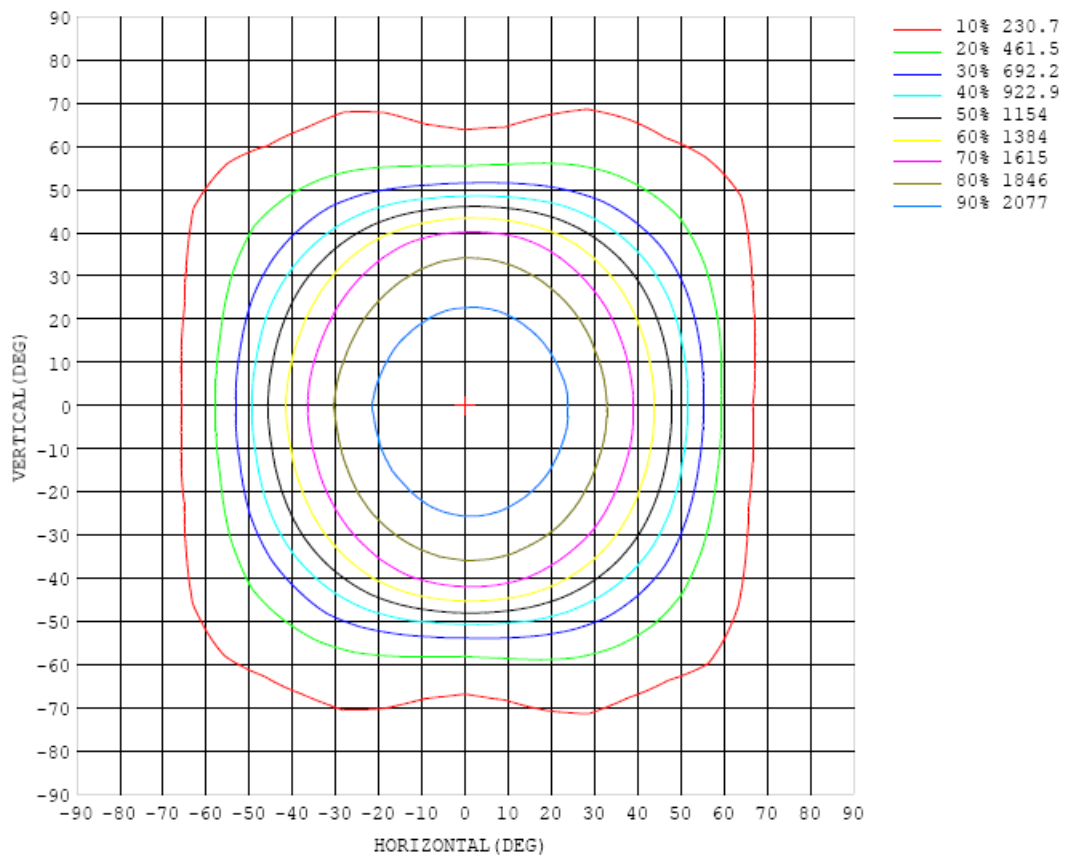


Chart 6: Isocandela Plot

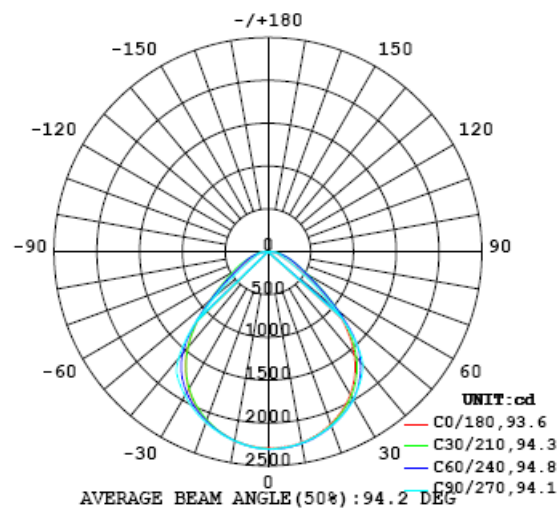


Chart 7: Polar Candela Distribution

## 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	2301	2301	2301	2301	2301	2301	2301	2301	2301	2301	2301	2301	2301	2301	2301	2301	2301	2301	2301
5	2283	2294	2300	2295	2299	2290	2299	2295	2298	2298	2288	2289	2292	2286	2294	2285	2275	2283	2272
10	2269	2271	2272	2272	2271	2267	2275	2276	2272	2268	2263	2261	2261	2257	2254	2241	2245	2245	2246
15	2211	2222	2223	2223	2223	2223	2227	2222	2225	2223	2217	2213	2208	2198	2206	2192	2185	2184	2177
20	2143	2147	2156	2154	2162	2156	2166	2171	2170	2165	2155	2150	2141	2133	2121	2112	2099	2103	2102
25	2049	2058	2059	2066	2069	2073	2089	2092	2090	2088	2082	2069	2058	2033	2028	2001	1998	1991	1988
30	1922	1930	1943	1945	1959	1972	1987	1995	2000	1993	1984	1970	1949	1930	1901	1874	1853	1850	1852
35	1771	1779	1783	1798	1822	1837	1858	1873	1875	1875	1855	1835	1808	1769	1745	1709	1682	1672	1674
40	1567	1579	1587	1605	1631	1651	1685	1711	1721	1723	1702	1670	1628	1578	1534	1495	1468	1454	1458
45	1321	1327	1341	1361	1385	1403	1424	1432	1424	1410	1394	1381	1358	1312	1279	1240	1210	1187	1190
50	1023	1025	1048	1068	1070	1068	1068	1044	1001	984	981	1000	1010	994	971	954	925	892	891
55	702	716	749	766	765	762	748	699	651	622	634	669	706	724	697	687	659	605	592
60	433	451	504	538	550	548	522	476	423	393	409	450	486	506	502	497	459	399	378
65	267	289	355	395	397	392	387	349	292	265	282	326	361	360	359	370	335	270	243
70	175	196	260	292	276	280	291	257	212	188	209	247	273	265	256	272	252	189	169
75	131	144	197	213	189	190	212	189	163	147	160	188	204	181	183	197	194	148	137
80	101	113	150	146	122	122	142	136	124	115	122	133	138	118	113	129	137	117	98.1
85	58.5	69.7	82.3	80.9	67.0	66.6	73.7	74.4	67.9	63.9	66.8	70.4	66.5	59.2	53.8	62.8	66.6	59.1	51.1
90	4.60	4.61	5.71	5.27	4.14	4.13	0.70	5.47	3.86	3.11	2.81	2.74	2.49	2.14	3.98	4.09	2.89	2.47	0.72
95	0.64	0.81	1.15	1.07	0.77	0.75	0.64	0.51	0.44	0.48	0.44	0.48	0.59	0.64	0.76	0.96	1.07	1.12	0.81
100	0.78	0.72	0.79	1.11	1.65	2.11	2.09	2.39	2.35	2.34	2.44	2.52	2.35	2.12	2.06	1.20	1.14	1.19	1.30
105	1.17	1.19	1.09	1.19	1.26	1.47	1.55	1.68	1.88	2.18	2.20	2.01	1.74	1.23	1.38	1.21	1.46	1.48	1.58
110	1.34	1.74	1.32	1.49	1.54	1.37	1.43	1.34	1.33	1.32	1.36	1.24	1.21	1.23	1.53	1.40	1.68	2.00	1.65
115	1.68	1.72	1.69	1.71	1.87	1.71	1.61	1.44	1.33	1.30	1.35	1.32	1.38	1.43	1.73	1.51	2.15	2.22	2.07
120	2.24	2.14	1.95	2.08	2.16	2.05	1.84	1.71	1.55	1.57	1.56	1.59	1.66	1.76	2.09	1.65	2.36	2.45	2.25
125	2.40	2.45	1.96	2.66	2.41	2.69	2.19	2.06	1.82	1.75	1.86	1.79	2.14	2.06	2.41	2.16	2.33	2.60	2.52
130	1.51	2.05	2.73	2.97	2.99	2.84	2.97	2.22	2.15	2.30	2.18	2.38	2.36	2.56	3.03	2.74	2.86	2.80	2.58
135	1.75	2.78	3.39	1.58	3.69	3.53	3.61	3.05	2.65	2.75	3.02	2.86	2.92	3.59	3.38	1.76	2.41	2.64	2.75
140	1.80	2.88	3.18	3.45	1.77	4.18	4.06	4.18	3.80	3.70	3.35	3.44	3.69	3.90	1.92	2.93	3.75	3.13	1.89
145	1.67	2.87	3.25	3.42	2.94	1.81	3.91	4.37	4.38	4.04	3.98	3.98	4.28	1.78	2.11	4.18	3.76	3.34	1.68
150	1.83	2.62	3.05	3.27	3.53	3.04	1.74	1.87	2.30	2.99	2.69	1.84	1.72	2.41	4.07	4.08	3.59	3.26	1.82
155	1.92	2.69	3.14	3.45	3.40	2.96	3.77	3.42	2.71	2.39	2.29	3.53	4.38	4.22	3.70	3.27	3.17	3.12	1.94
160	1.74	2.22	2.66	2.74	2.83	3.35	3.88	3.77	3.97	3.50	3.35	4.11	3.90	3.79	3.76	3.09	2.53	2.32	1.81
165	1.76	1.96	2.41	2.83	3.30	3.51	3.51	3.81	3.85	3.38	3.12	3.65	3.50	3.43	2.91	2.60	2.35	2.17	1.82
170	1.99	2.11	2.35	2.84	2.93	3.01	3.16	3.35	3.11	2.90	2.81	2.98	2.65	2.62	2.48	2.51	2.50	2.36	2.08
175	2.24	2.29	2.41	2.58	2.75	2.73	2.67	2.67	2.61	2.61	2.41	2.14	2.22	2.69	2.80	2.75	2.59	2.45	2.23
180	2.27	2.32	2.35	2.35	2.36	2.34	2.25	2.27	1.99	2.20	2.12	2.18	2.22	2.27	2.25	2.21	2.18	2.23	2.26

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	2301	2301	2301	2301	2301	2301	2301	2301	2301	2301	2301	2301	2301	2301	2301	2301	2301		
5	2280	2287	2282	2284	2273	2285	2288	2285	2286	2283	2284	2289	2285	2298	2284	2286	2293		
10	2242	2242	2238	2240	2236	2243	2237	2239	2245	2240	2245	2252	2254	2256	2261	2262	2270		
15	2183	2185	2175	2174	2174	2179	2183	2190	2186	2193	2193	2195	2195	2209	2204	2209	2216		
20	2095	2093	2088	2093	2089	2108	2112	2114	2124	2119	2123	2128	2128	2128	2125	2132	2148		
25	1987	1987	1981	1991	1996	2012	2020	2037	2039	2041	2043	2043	2037	2043	2038	2040	2047		
30	1847	1839	1843	1860	1875	1897	1915	1927	1936	1943	1940	1938	1933	1923	1916	1908	1929		
35	1664	1665	1670	1692	1717	1763	1791	1815	1829	1823	1820	1805	1787	1782	1763	1759	1763		
40	1448	1442	1454	1474	1507	1554	1588	1609	1622	1636	1644	1625	1601	1581	1570	1560	1568		
45	1177	1187	1190	1196	1211	1228	1230	1230	1248	1267	1294	1321	1326	1330	1319	1313	1316		
50	879	892	887	880	879	871	838	798	798	821	880	946	979	1005	1022	1034	1030		
55	602	632	635	633	625	587	538	494	478	509	570	630	679	703	730	742	728		
60	398	447	474	462	440	412	372	331	310	332	392	444	481	503	517	509	479		
65	270	332	355	319	311	312	281	235	212	226	281	335	351	361	383	370	318		
70	187	251	253	226	224	239	218	180	154	167	208	249	257	249	271	277	213		
75	146	191	180	158	149	173	163	140	125	133	155	182	173	170	191	207	155		
80	112	130	117	93.5	91.2	107	109	102	93.6	98.4	109	122	110	103	130	148	120		
85	56.0	60.6	51.4	42.0	39.7	42.8	45.6	43.8	41.8	45.2	54.1	57.7	57.1	57.3	72.7	75.5	73.2		
90	1.78	4.93	0.97	2.52	1.89	0.67	0.36	0.27	0.27	0.29	0.30	0.37	0.53	0.85	0.88	1.34	1.60		
95	1.58	1.33	1.74	2.30	1.64	1.17	0.89	0.68	0.59	0.59	0.58	0.67	0.71	0.71	0.94	1.00	1.06		
100	1.66	1.85	0.91	1.52	1.58	1.80	1.78	1.46	1.48	1.79	1.64	1.82	1.87	1.57	0.98	0.82	0.77		
105	2.03	1.98	1.06	1.44	1.33	1.34	1.13	1.23	1.23	1.25	1.25	1.22	1.32	1.20	1.23	1.13	1.11		
110	1.80	1.79	1.11	1.69	1.28	1.20	1.14	1.19	1.23	1.35	1.30	1.34	1.31	1.55	1.51	1.29	1.74		
115	2.07	2.45	1.19	1.88	1.54	1.43	1.25	1.30	1.33	1.34	1.38	1.54	1.75	1.86	1.74	1.59	1.65		
120	2.65	2.42	1.40	1.98	2.00	1.57	1.46	1.54	1.59	1.63	1.80	1.91	1.97	2.20	2.14	2.07	2.20		
125	3.07	2.36	1.91	2.40	2.28	2.24	1.88	1.78	1.90	1.85	1.96	2.27	2.67	2.59	2.75	1.77	2.49		
130	2.91	2.91	1.75	3.50	2.82	2.99	2.69	2.40	2.17	2.40	2.40	3.06	3.07	3.06	3.17	2.80	1.92		
135	3.30	2.43	1.72	4.17	3.81	3.67	3.59	3.32	3.33	2.97	3.33	3.71	3.71	4.09	1.55	3.36	2.93		
140	2.94	3.21	3.09	1.94	4.65	4.40	4.34	4.03	4.24	4.36	4.65	4.24	4.37	1.73	2.99	2.97	2.69		
145	2.76	3.41	3.57	3.60	1.97	3.14	5.00	5.01	5.10	5.17	5.01	3.43	1.81	3.16	3.11	3.05	2.75		
150	2.86	3.26	3.52	3.56	3.00	2.44	2.10	2.12	2.18	2.03	1.93	2.01	3.00	3.33	3.12	2.91	2.67		
155	2.73	2.82	2.76	2.89	3.38	3.42	3.81	3.44	3.08	3.37	3.82	3.62	2.75	3.02	3.33	2.95	2.73		
160	2.00	2.27	2.48	3.01	3.42	3.44	3.48	3.50	3.42	3.77	3.81	3.96	3.67	2.98	2.79	2.53	2.33		
165	1.86	2.16	2.17	2.30	2.61	3.29	3.24	3.35	3.27	3.48	3.72	3.57	3.58	3.24	2.87	2.56	2.12		
170	2.09	2.21	2.47	2.48	2.40	2.36	2.49	2.88	2.77	2.76	2.91	2.95	2.74	2.77	2.64	2.69	2.10		
175	2.23	2.28	2.39	2.59	2.73	2.76	2.42	2.18	2.25	2.51	2.49	2.52	2.51	2.54	2.54	2.31	2.19		
180	2.27	2.30	2.32	2.33	2.32	2.35	2.29	2.31	2.15	2.16	2.14	2.24	2.24	2.29	2.26	2.25	2.26		

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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