

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-40-L2

ULB4-40L-U-40-L2-MWS

40LB/4F/840/U/A2

40LB/4F/840/U/A2/MWS

Laboratory: Leading Testing Laboratories

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Report No.: HZ25030014v

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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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-40-L2**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
130.4	5144.3	39.44	0.9961
CCT (K)	CRI	Stabilization Time (Light & Power)	
3993	83.0	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	: Mar. 18, 2025
Date of Test	: Mar. 27, 2025
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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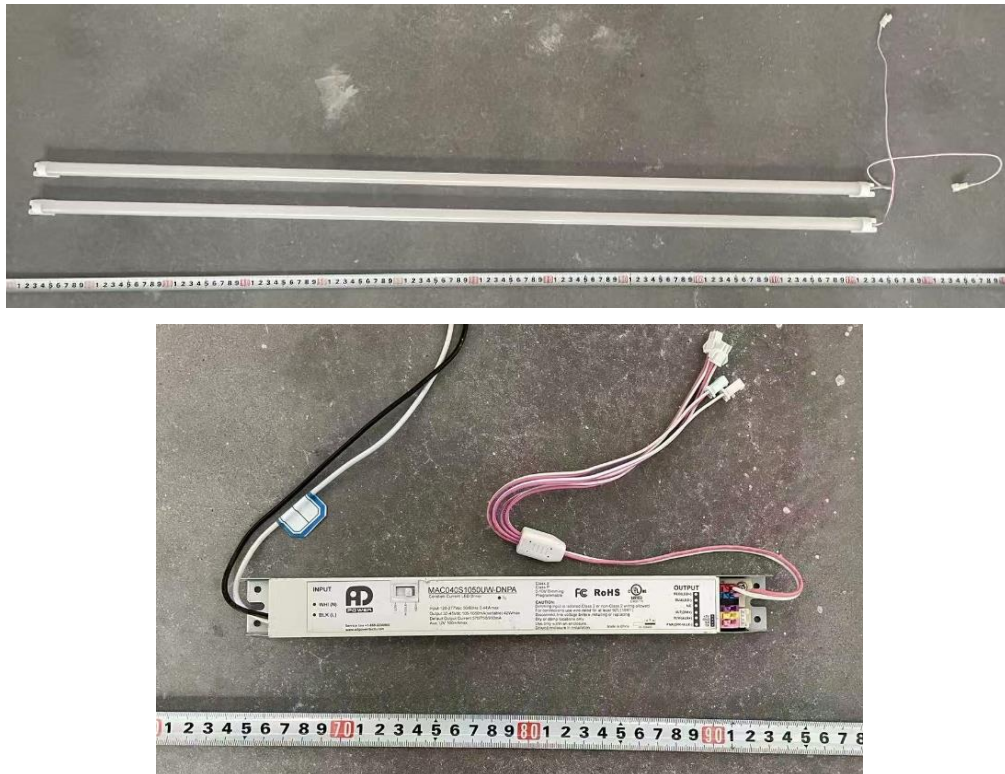


Figure 1- Overview of the sample



Sample in Lithonia 2GT8 lensed 2x4

Equipment Under Test(EUT)

Name	: LED Retrofit-kits	
Model	: ULB4-40L-U-40-L2	ULB4-40L-U-40-L2-MWS
	40LB/4F/840/U/A2	40LB/4F/840/U/A2/MWS
Electrical Ratings	: 120-277V, 50/60Hz	
Product Description	: Field-Adjustable 40W/36W/32W, 4000K LED Tube supplied by a LED driver: MAC040S1050UW-DNPA	
Manufacturer	: Industrial Lighting Products, LLC	
Address	: 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)	0.330	0.147
Power Factor	0.9961	0.9618
Test Power (W)	39.44	39.20
THD A%	7.01	15.18
Luminous Efficacy (lm/W)	130.4	131.6
Total Luminous Flux (lm)	5144.3	5159.6
Color Rendering Index (CRI)	83.0	
R9	10	
Correlated Color Temperature (CCT)(K)	3993	
Chromaticity Chroma x	0.3808	
Chromaticity Chroma y	0.3776	
Chromaticity Chroma u	0.2250	
Chromaticity Chroma v	0.3347	
Duv	0.0003	
Chromaticity Chroma u'	0.2250	
Chromaticity Chroma v'	0.5020	

Special Color Rendering Indices	
R1	81.5
R2	88.5
R3	94
R4	82.7
R5	81.6
R6	84.1
R7	86.4
R8	65.5
R9	10
R10	73
R11	82
R12	61
R13	83.1
R14	96.8

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)	0.330
Power Factor	0.9960
Power (W)	39.49
Luminous Efficacy (lm/W)	130.5
Total Luminous Flux (lm)	5154.6
Beam Angle (°)	94.0 (0°-180°) / 95.2 (90°-270°)
Center Beam Candle Power (cd)	2329
Maximum Beam Candle Power (cd)	2334 (At: C=340.0, Gamma=2.0)
Spacing Criteria	1.20 (0°-180°) / 1.26 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	88.37%
Zonal Lumens in the 60 °-90 °Zone	11.35%
Zonal Lumens in the 90 °-120 °Zone	0.10%
Zonal Lumens in the 120 °-180 °Zone	0.18%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

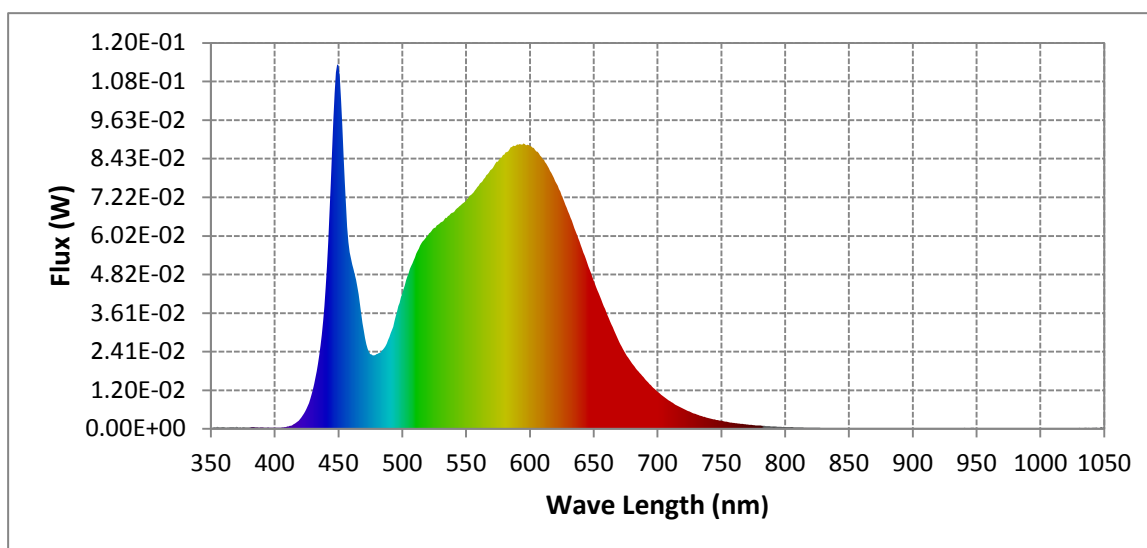
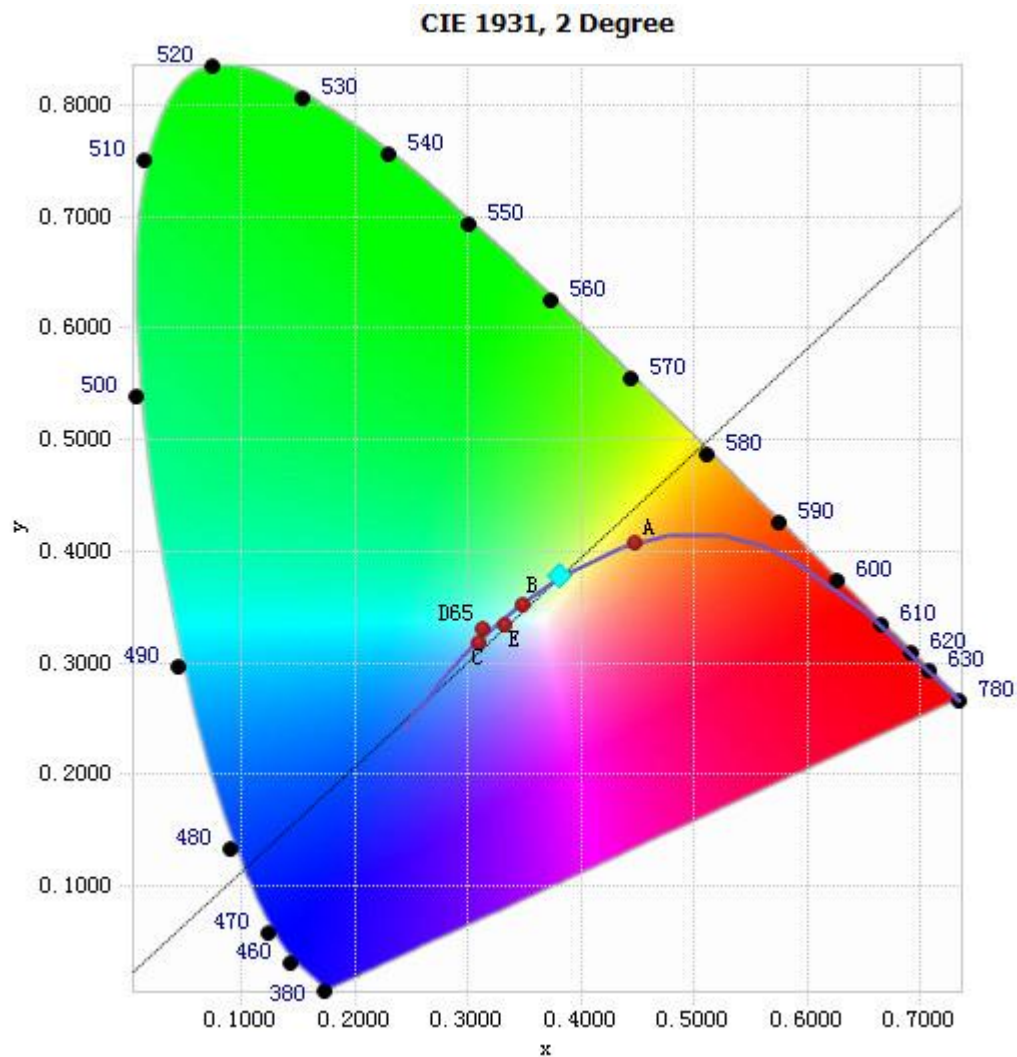


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	4.34E-04	485	2.47E-02	590	8.87E-02	695	1.36E-02
385	4.02E-04	490	2.86E-02	595	8.90E-02	700	1.17E-02
390	4.74E-04	495	3.52E-02	600	8.83E-02	705	1.00E-02
395	4.12E-04	500	4.21E-02	605	8.65E-02	710	8.59E-03
400	3.28E-04	505	4.85E-02	610	8.41E-02	715	7.36E-03
405	3.66E-04	510	5.35E-02	615	8.13E-02	720	6.30E-03
410	7.05E-04	515	5.78E-02	620	7.72E-02	725	5.41E-03
415	1.43E-03	520	6.02E-02	625	7.28E-02	730	4.60E-03
420	3.02E-03	525	6.26E-02	630	6.78E-02	735	3.91E-03
425	6.25E-03	530	6.44E-02	635	6.26E-02	740	3.36E-03
430	1.22E-02	535	6.58E-02	640	5.72E-02	745	2.89E-03
435	2.30E-02	540	6.74E-02	645	5.17E-02	750	2.50E-03
440	4.40E-02	545	6.95E-02	650	4.63E-02	755	2.13E-03
445	8.66E-02	550	7.10E-02	655	4.13E-02	760	1.81E-03
450	1.13E-01	555	7.34E-02	660	3.63E-02	765	1.57E-03
455	7.65E-02	560	7.58E-02	665	3.17E-02	770	1.36E-03
460	5.32E-02	565	7.83E-02	670	2.72E-02	775	1.17E-03
465	4.43E-02	570	8.09E-02	675	2.34E-02	780	1.03E-03
470	3.07E-02	575	8.33E-02	680	2.04E-02		
475	2.33E-02	580	8.56E-02	685	1.79E-02		
480	2.33E-02	585	8.78E-02	690	1.57E-02		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3808, 0.3776)

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

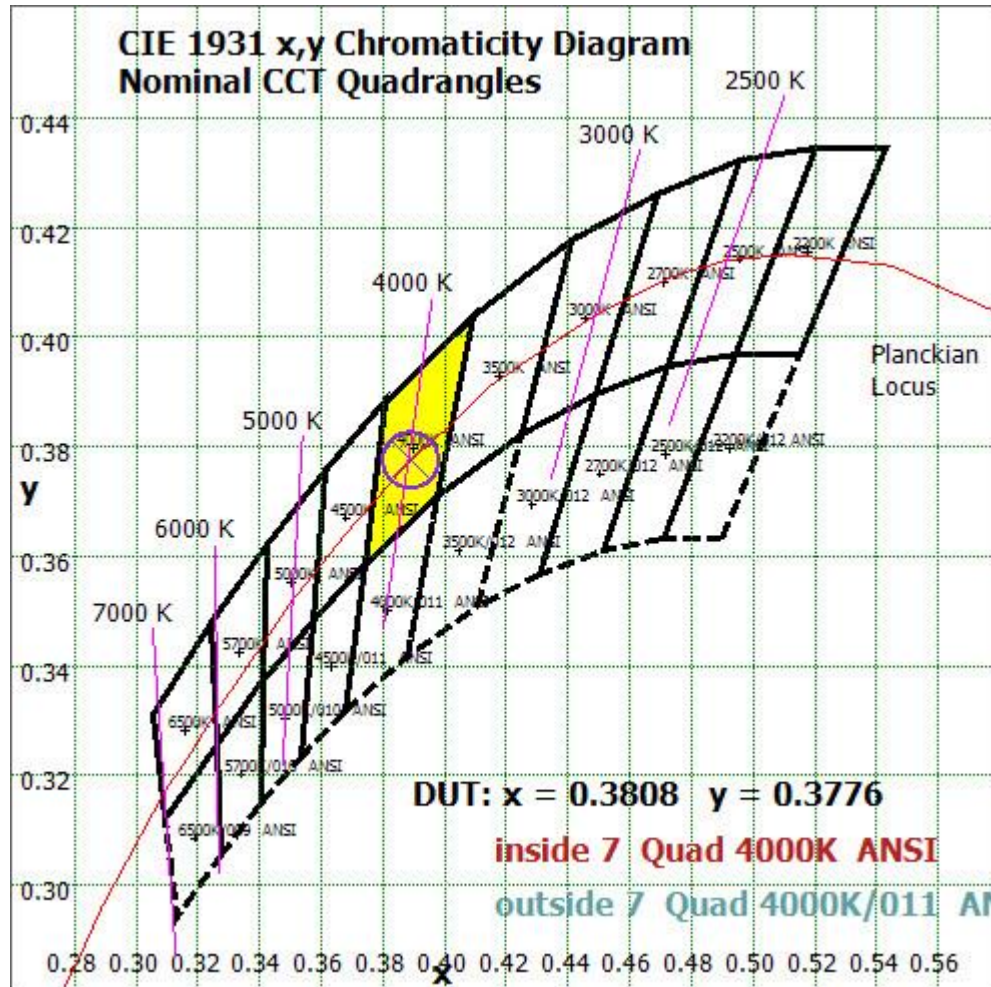
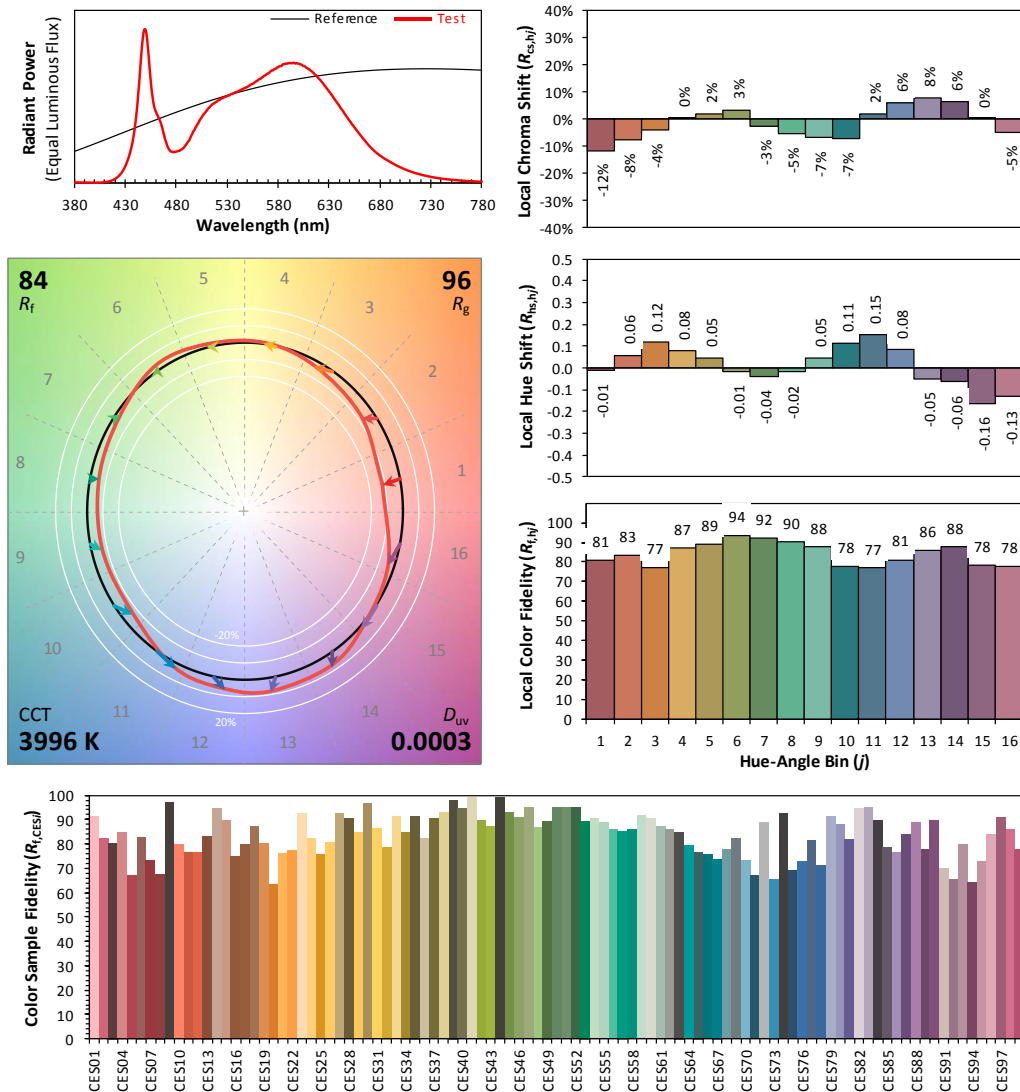


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

**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-40-L2

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

x 0.3808
 y 0.3776
 u' 0.2250
 v' 0.5020

CIE 13.3-1995
(CRI)
 R_a 83
 R_g 10

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	220.189	4.27%
10- 20	630.372	12.23%
20- 30	950.615	18.44%
30- 40	1119.873	21.73%
40- 50	1016.018	19.71%
50- 60	618.011	11.99%
60- 70	332.489	6.45%
70- 80	186.475	3.62%
80- 90	65.991	1.28%
90-100	1.305	0.03%
100-110	2.219	0.04%
110-120	1.771	0.03%
120-130	2.026	0.04%
130-140	2.263	0.04%
140-150	2.149	0.04%
150-160	1.639	0.03%
160-170	0.934	0.02%
170-180	0.257	0.00%
Total	5154.6	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	4555.078	88.37%
60- 90	584.955	11.35%
0-90	5140.033	99.72%
90- 180	14.563	0.28%
0- 180	5154.6	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

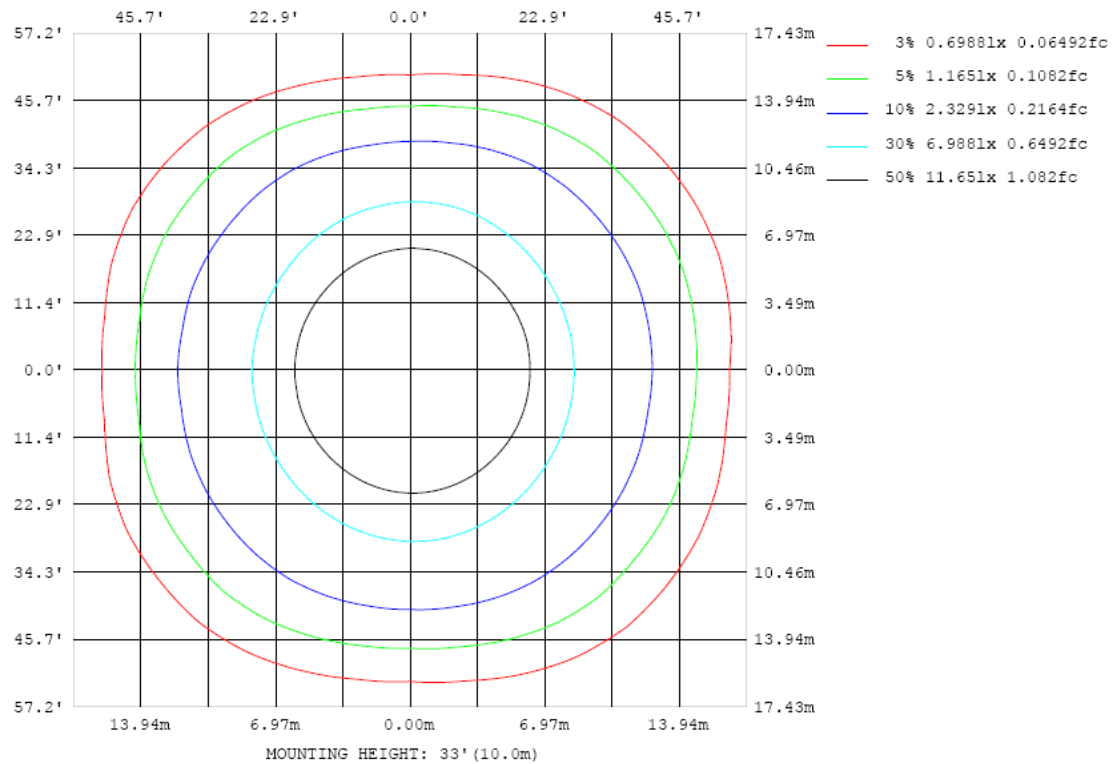


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

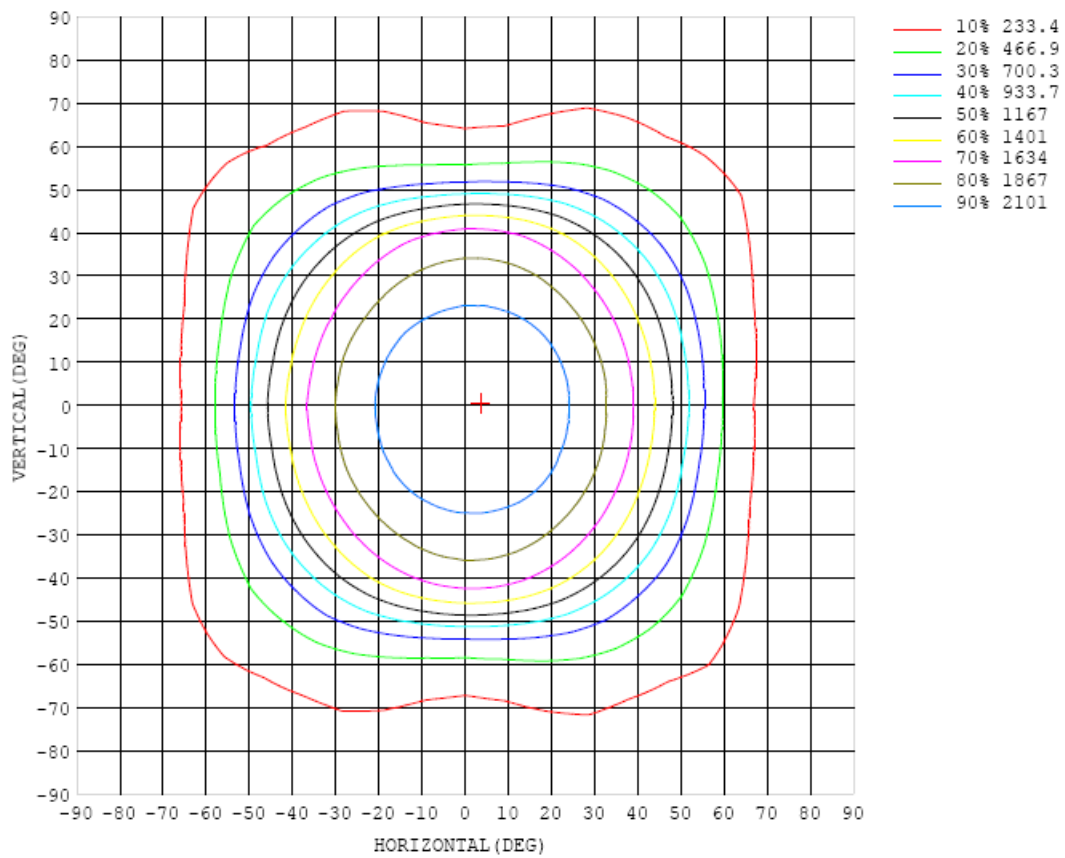


Chart 6: Isocandela Plot

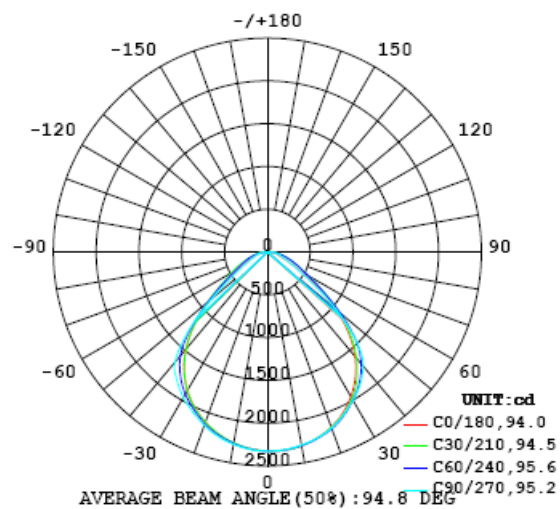


Chart 7: Polar Candela Distribution

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	2329	2329	2329	2329	2329	2329	2329	2329	2329	2329	2329	2329	2329	2329	2329	2329	2329	2329	2329
5	2322	2322	2319	2319	2322	2326	2320	2326	2327	2321	2324	2312	2313	2316	2312	2307	2318	2297	2307
10	2301	2303	2305	2300	2298	2298	2301	2300	2293	2288	2289	2287	2281	2276	2274	2272	2269	2270	2266
15	2249	2248	2249	2252	2253	2257	2253	2257	2258	2254	2253	2237	2233	2226	2219	2211	2214	2196	2206
20	2179	2180	2179	2182	2192	2197	2199	2203	2197	2191	2183	2177	2166	2155	2142	2130	2123	2117	2116
25	2080	2079	2088	2098	2105	2110	2108	2112	2107	2097	2099	2080	2072	2061	2048	2034	2024	2005	2010
30	1951	1956	1963	1975	1987	1994	2001	2004	2007	2001	1991	1975	1953	1936	1917	1900	1886	1866	1870
35	1792	1792	1812	1817	1834	1852	1871	1893	1899	1892	1880	1847	1819	1785	1755	1730	1713	1694	1695
40	1590	1597	1602	1620	1646	1675	1706	1731	1742	1739	1719	1683	1638	1594	1549	1517	1497	1469	1479
45	1348	1339	1356	1375	1406	1434	1465	1481	1480	1468	1446	1423	1389	1341	1300	1263	1233	1206	1213
50	1049	1042	1064	1086	1097	1107	1111	1096	1062	1043	1042	1047	1046	1025	996	973	947	899	911
55	728	723	762	785	787	791	776	728	676	644	662	698	733	737	723	704	672	614	607
60	448	463	515	549	564	569	540	493	438	408	428	467	503	525	516	507	469	402	386
65	277	296	361	404	408	406	399	359	300	275	293	339	372	373	369	378	341	274	249
70	181	201	266	299	283	290	299	263	217	193	217	255	281	274	262	280	257	192	171
75	133	146	200	218	194	197	218	194	166	150	166	194	209	186	189	200	198	151	140
80	103	116	152	149	125	126	146	140	128	119	127	138	143	121	119	133	140	118	101
85	59.7	71.5	83.5	82.8	69.1	69.4	77.5	79.1	73.4	71.0	73.8	76.8	71.1	61.8	56.2	65.9	71.0	60.6	52.1
90	4.40	4.59	5.89	5.48	4.38	3.85	0.73	4.48	3.69	2.99	2.67	2.70	2.39	2.15	4.18	4.59	4.40	2.58	0.72
95	0.67	0.83	0.99	0.93	0.66	0.67	0.58	0.47	0.42	0.36	0.39	0.43	0.54	0.54	0.85	1.06	1.12	1.07	0.82
100	0.77	0.70	0.80	2.20	2.28	2.49	2.82	2.45	2.29	2.18	2.30	2.59	2.94	2.36	2.63	1.58	1.16	1.18	1.35
105	1.16	1.16	1.08	1.19	1.50	3.01	3.48	3.36	3.39	3.28	3.62	3.79	3.95	3.08	1.60	1.23	1.45	1.50	1.72
110	1.30	1.73	1.37	1.51	1.47	1.55	1.58	2.00	2.41	2.74	2.31	1.75	1.33	1.33	1.51	1.42	1.71	1.79	1.78
115	1.60	2.29	1.73	1.74	1.81	1.67	1.72	1.63	1.59	1.51	1.50	1.42	1.38	1.39	1.70	1.50	2.16	2.15	2.19
120	2.04	2.54	1.81	1.97	2.16	2.01	1.77	1.70	1.64	1.63	1.60	1.50	1.58	1.73	1.93	1.66	2.40	3.01	2.22
125	2.44	2.91	1.90	2.55	2.56	2.33	2.04	1.92	1.76	1.79	1.77	1.79	1.94	2.02	2.35	2.08	2.20	3.22	2.52
130	1.53	2.11	2.64	2.73	3.07	2.62	2.60	2.08	1.98	1.98	1.96	2.03	2.30	2.43	3.01	2.86	2.60	3.09	2.90
135	1.86	3.71	3.99	1.67	3.70	3.31	2.74	2.52	2.27	2.44	2.45	2.67	2.72	3.15	3.28	1.82	2.45	2.50	2.90
140	1.98	3.53	3.75	3.97	2.09	3.90	3.37	3.10	2.74	2.79	2.88	3.24	3.47	3.29	1.98	2.73	4.47	3.49	1.72
145	1.73	3.45	4.08	4.47	3.04	2.11	3.52	3.19	3.14	2.87	3.34	3.40	3.53	1.92	1.99	5.09	4.53	3.97	1.78
150	2.02	3.22	3.70	4.17	4.73	3.53	1.74	2.11	2.60	3.35	2.98	1.91	1.74	2.05	4.60	5.09	4.47	4.12	1.98
155	2.02	3.16	3.86	4.30	4.35	3.20	4.02	3.37	2.12	1.91	1.93	2.93	4.79	5.07	4.53	3.51	3.50	3.48	2.04
160	1.84	2.55	3.21	3.07	3.18	3.84	4.81	4.60	4.59	4.25	4.18	5.06	4.87	4.50	4.31	3.48	2.76	2.47	1.90
165	1.78	2.00	2.49	3.08	3.68	3.89	4.10	4.17	4.22	3.77	3.63	4.17	3.99	3.74	2.84	2.71	2.50	2.34	1.94
170	2.04	2.19	2.52	3.04	3.13	3.25	3.50	3.60	3.67	3.28	3.36	3.38	2.63	2.63	2.52	2.60	2.65	2.51	2.11
175	2.32	2.40	2.50	2.75	2.95	2.97	2.96	3.00	2.96	2.90	2.60	2.20	2.27	2.96	3.09	3.06	2.87	2.61	2.33
180	2.35	2.39	2.41	2.42	2.42	2.42	2.31	2.30	2.00	2.23	2.13	2.19	2.23	2.29	2.27	2.29	2.31	2.38	2.35

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	2329	2329	2329	2329	2329	2329	2329	2329	2329	2329	2329	2329	2329	2329	2329	2329	2329		
5	2303	2309	2307	2308	2311	2307	2319	2318	2312	2322	2314	2317	2322	2323	2323	2330	2317		
10	2267	2264	2264	2269	2270	2276	2279	2281	2283	2286	2287	2291	2296	2299	2296	2308	2302		
15	2201	2205	2205	2203	2213	2213	2222	2226	2233	2240	2237	2241	2244	2247	2251	2252	2250		
20	2116	2114	2118	2126	2131	2142	2150	2155	2152	2165	2169	2172	2180	2180	2177	2188	2177		
25	2005	2007	2009	2017	2026	2030	2046	2051	2065	2072	2070	2076	2080	2081	2083	2083	2085		
30	1862	1869	1875	1883	1897	1920	1940	1958	1964	1975	1972	1966	1963	1962	1961	1964	1950		
35	1687	1683	1692	1711	1742	1771	1809	1828	1840	1849	1844	1836	1822	1803	1795	1797	1798		
40	1460	1464	1477	1498	1536	1582	1627	1654	1680	1692	1678	1654	1632	1613	1599	1592	1585		
45	1193	1199	1214	1222	1246	1266	1279	1288	1310	1334	1366	1383	1374	1356	1346	1346	1342		
50	888	908	904	901	904	898	872	835	840	876	940	998	1025	1041	1052	1057	1048		
55	611	642	648	643	644	608	554	509	495	527	590	657	709	729	752	763	744		
60	404	452	483	472	452	422	385	341	321	345	405	458	499	521	530	522	489		
65	275	337	363	325	318	320	289	243	218	233	290	345	362	372	392	378	323		
70	190	253	258	230	230	245	224	185	158	170	213	255	265	256	278	282	216		
75	150	193	181	162	152	177	168	145	127	135	159	187	177	174	194	210	155		
80	113	132	119	97.3	93.3	110	112	105	95.7	101	112	125	112	105	133	151	120		
85	58.8	62.4	53.6	44.1	41.0	44.7	48.4	47.1	45.1	48.1	56.5	59.4	58.2	58.2	74.7	76.4	72.6		
90	2.19	3.82	0.88	2.58	0.81	0.49	0.36	0.28	0.28	0.30	0.31	0.47	0.56	0.83	1.08	1.20	1.80		
95	1.42	1.27	1.53	2.28	1.12	0.67	0.55	0.49	0.46	0.48	0.51	0.61	0.70	0.72	0.97	1.09	1.18		
100	1.76	1.69	1.06	2.83	2.63	2.45	2.28	2.66	2.60	2.46	2.11	1.79	1.82	1.92	1.94	0.90	0.80		
105	1.96	2.44	1.29	1.59	1.78	2.76	3.21	3.31	3.21	3.17	2.81	2.67	2.35	1.48	1.27	1.16	1.18		
110	2.67	2.35	1.39	1.91	1.45	1.49	1.41	1.54	1.66	1.71	1.58	1.52	1.51	1.55	1.61	1.35	1.56		
115	2.91	2.68	1.54	2.11	1.71	1.65	1.47	1.49	1.56	1.56	1.59	1.68	1.70	1.89	1.86	1.65	2.34		
120	3.03	2.30	1.73	2.32	1.98	1.81	1.74	1.70	1.73	1.73	1.82	1.85	2.09	2.20	2.10	1.94	2.79		
125	3.37	2.75	2.05	2.61	2.37	2.27	2.01	1.94	1.96	1.91	1.99	2.34	2.34	2.72	2.67	1.76	2.94		
130	3.26	3.37	2.03	3.26	2.90	2.71	2.44	2.34	2.27	2.29	2.34	2.66	3.04	3.50	2.82	3.04	2.17		
135	3.30	2.53	1.64	3.70	3.75	3.35	2.96	2.83	2.70	2.73	2.87	2.99	3.85	3.78	1.76	4.21	3.91		
140	3.58	3.99	4.67	2.04	4.33	3.71	3.80	3.45	3.16	3.18	3.52	3.64	4.34	2.16	3.88	3.77	3.54		
145	3.76	4.33	4.87	4.93	2.09	3.44	4.31	4.08	4.08	3.94	3.73	3.37	2.07	3.80	4.12	3.84	3.36		
150	3.81	4.20	4.59	4.84	4.15	2.34	2.36	2.50	2.64	2.41	2.25	2.01	3.99	4.48	4.03	3.65	3.27		
155	3.29	3.51	3.42	3.90	4.79	4.99	5.13	4.07	3.25	3.81	4.61	4.90	3.29	3.88	4.10	3.67	3.23		
160	2.11	2.58	3.03	3.67	4.24	4.33	4.58	4.47	4.41	4.71	4.61	4.52	4.22	3.18	3.13	3.05	2.71		
165	1.93	2.34	2.38	2.64	2.87	3.78	3.97	3.98	3.89	3.94	4.06	3.93	3.90	3.70	3.18	2.86	2.22		
170	2.11	2.26	2.60	2.65	2.51	2.51	2.58	3.30	3.25	3.15	3.41	3.31	3.18	3.02	2.90	2.84	2.19		
175	2.33	2.34	2.48	2.76	2.95	2.98	2.56	2.24	2.35	2.79	2.78	2.78	2.73	2.71	2.65	2.37	2.23		
180	2.35	2.38	2.40	2.40	2.40	2.41	2.36	2.37	2.19	2.19	2.17	2.29	2.30	2.35	2.32	2.32	2.32		

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 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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