

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-L4

ULB4-40L-U-40-L4-MWS

40LB/4F/840/U/A4

40LB/4F/840/U/A4/MWS

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ25030014x

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

Review by:

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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: **ULB4-40L-U-40-L4**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
131.8	5102.1	38.71	0.9957
CCT (K)	CRI	Stabilization Time (Light & Power)	
3986	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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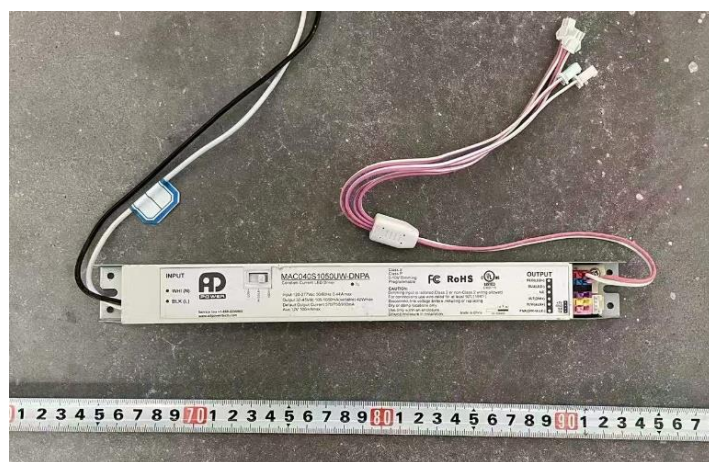
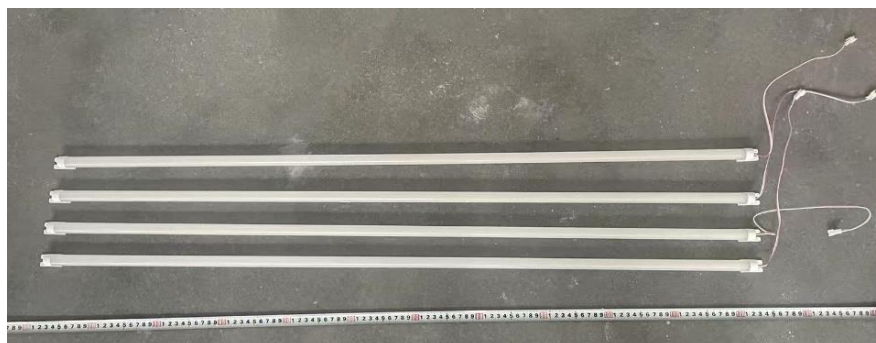


Figure 1- Overview of the sample



Sample in Lithonia 2GT8 lensed 2x4

Equipment Under Test(EUT)

Name	: LED Retrofit-kits		
Model	: ULB4-40L-U-40-L4	ULB4-40L-U-40-L4-MWS	
	40LB/4F/840/U/A4	40LB/4F/840/U/A4/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)	0.324	0.145
Power Factor	0.9957	0.9605
Test Power (W)	38.71	38.46
THD A%	7.21	15.30
Luminous Efficacy (lm/W)	131.8	133.0
Total Luminous Flux (lm)	5102.1	5116.6
Color Rendering Index (CRI)	83.0	
R9	9.9	
Correlated Color Temperature (CCT)(K)	3986	
Chromaticity Chroma x	0.3812	
Chromaticity Chroma y	0.3782	
Chromaticity Chroma u	0.2251	
Chromaticity Chroma v	0.3349	
Duv	0.0005	
Chromaticity Chroma u'	0.2251	
Chromaticity Chroma v'	0.5023	

Special Color Rendering Indices	
R1	81.4
R2	88.5
R3	93.9
R4	82.8
R5	81.5
R6	84.1
R7	86.4
R8	65.4
R9	9.9
R10	72.8
R11	82.2
R12	61
R13	83.1
R14	96.7

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)	0.324
Power Factor	0.9959
Power (W)	38.74
Luminous Efficacy (lm/W)	132.0
Total Luminous Flux (lm)	5112.0
Beam Angle (°)	93.7 (0°-180°) / 93.9 (90°-270°)
Center Beam Candle Power (cd)	2327
Maximum Beam Candle Power (cd)	2335 (At: C=100.0, Gamma=0.5)
Spacing Criteria	1.20 (0°-180°) / 1.27 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	88.48%
Zonal Lumens in the 60 °-90 °Zone	11.26%
Zonal Lumens in the 90 °-120 °Zone	0.10%
Zonal Lumens in the 120 °-180 °Zone	0.17%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

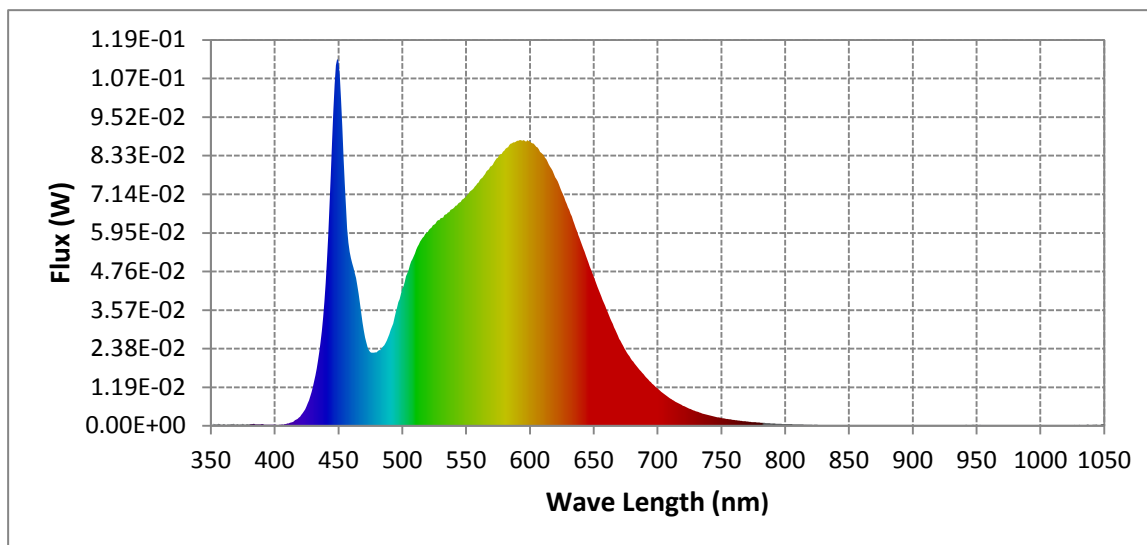
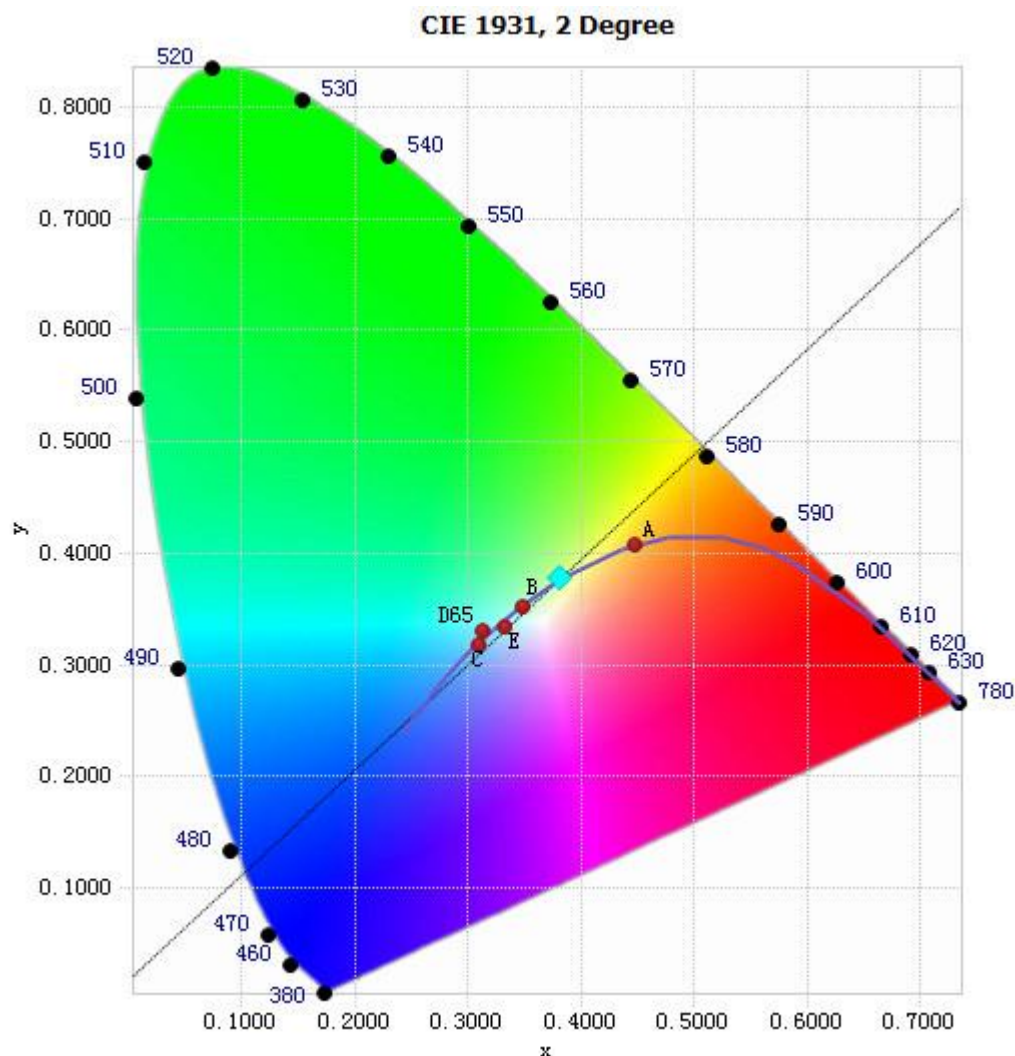


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	4.56E-04	485	2.44E-02	590	8.79E-02	695	1.34E-02
385	4.00E-04	490	2.83E-02	595	8.81E-02	700	1.16E-02
390	4.95E-04	495	3.50E-02	600	8.77E-02	705	9.91E-03
395	3.80E-04	500	4.22E-02	605	8.60E-02	710	8.47E-03
400	3.78E-04	505	4.80E-02	610	8.37E-02	715	7.24E-03
405	3.69E-04	510	5.32E-02	615	8.06E-02	720	6.21E-03
410	7.25E-04	515	5.73E-02	620	7.66E-02	725	5.32E-03
415	1.32E-03	520	5.98E-02	625	7.23E-02	730	4.51E-03
420	2.85E-03	525	6.21E-02	630	6.73E-02	735	3.84E-03
425	6.00E-03	530	6.40E-02	635	6.22E-02	740	3.30E-03
430	1.20E-02	535	6.53E-02	640	5.68E-02	745	2.82E-03
435	2.28E-02	540	6.70E-02	645	5.13E-02	750	2.45E-03
440	4.40E-02	545	6.88E-02	650	4.61E-02	755	2.09E-03
445	8.75E-02	550	7.05E-02	655	4.09E-02	760	1.79E-03
450	1.12E-01	555	7.28E-02	660	3.60E-02	765	1.55E-03
455	7.41E-02	560	7.50E-02	665	3.14E-02	770	1.33E-03
460	5.16E-02	565	7.76E-02	670	2.68E-02	775	1.15E-03
465	4.32E-02	570	8.01E-02	675	2.32E-02	780	9.88E-04
470	2.95E-02	575	8.27E-02	680	2.02E-02		
475	2.27E-02	580	8.48E-02	685	1.77E-02		
480	2.27E-02	585	8.70E-02	690	1.55E-02		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3812, 0.3782)

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

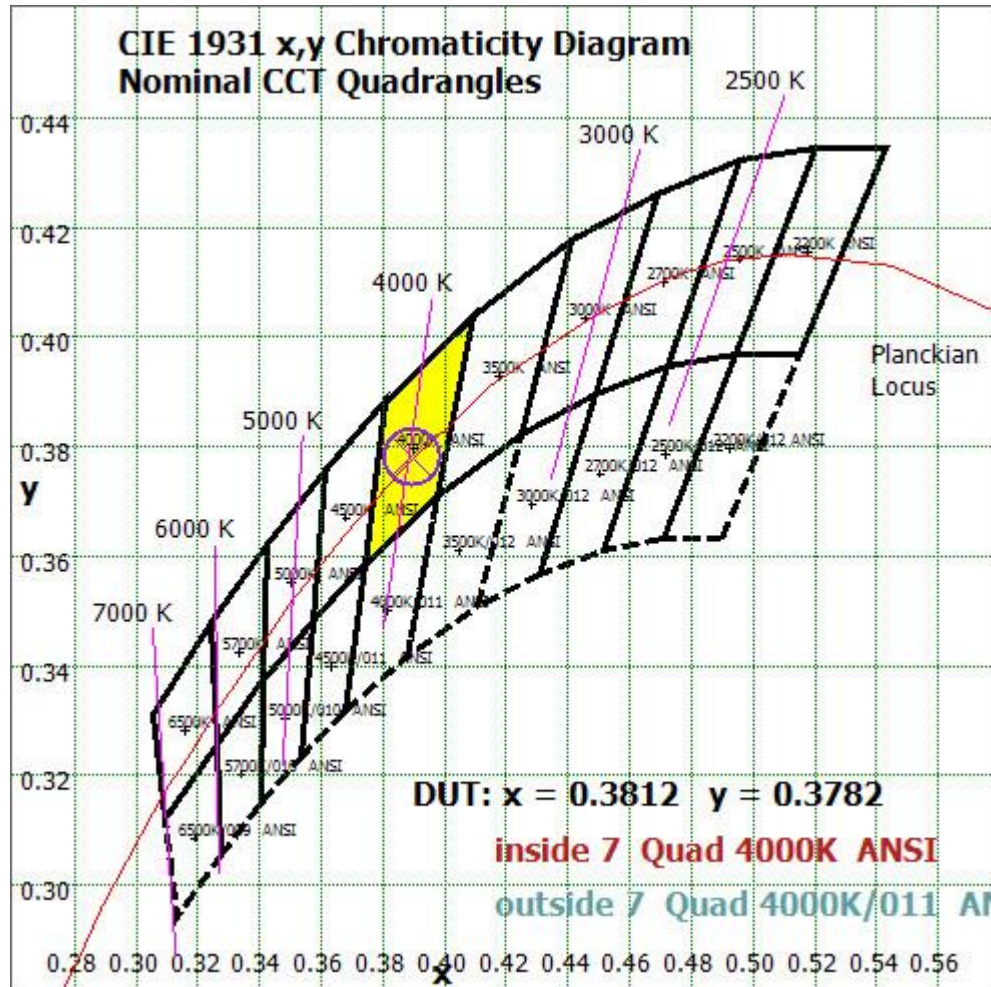


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram



Quality Assured
Color Rendition Report – Sphere Spectroradiometer Method

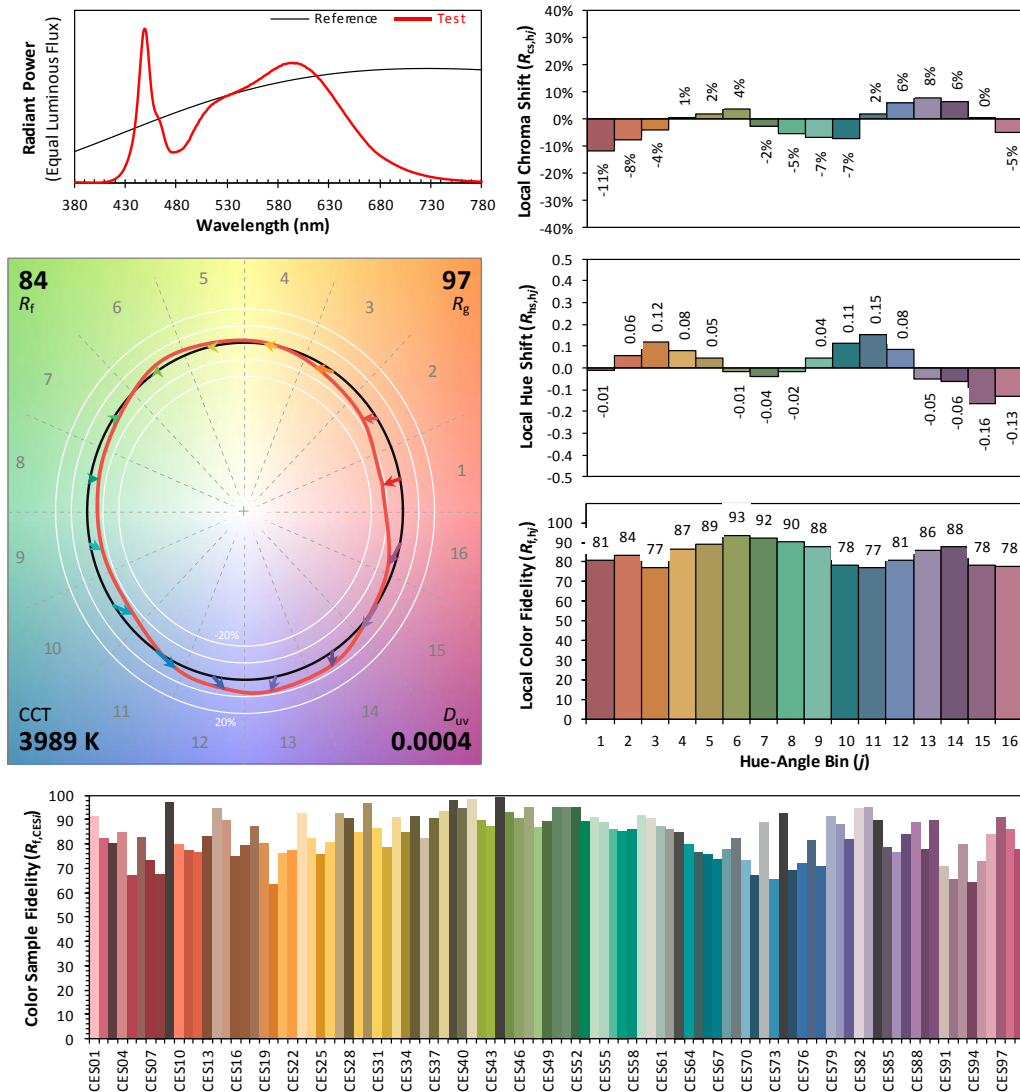
ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: Industrial Lighting Products, LLC

Date: 2025/03/27

Model: ULB4-40L-U-40-L4



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

x 0.3812
 y 0.3782
 u' 0.2251
 v' 0.5023

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	220.025	4.30%
10- 20	629.189	12.31%
20- 30	950.152	18.59%
30- 40	1119.146	21.89%
40- 50	999.026	19.54%
50- 60	605.397	11.84%
60- 70	326.989	6.40%
70- 80	184.035	3.60%
80- 90	64.334	1.26%
90-100	1.084	0.02%
100-110	1.881	0.04%
110-120	1.992	0.04%
120-130	2.083	0.04%
130-140	2.261	0.04%
140-150	1.939	0.04%
150-160	1.37	0.03%
160-170	0.844	0.02%
170-180	0.248	0.00%
Total	5112.0	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	4522.935	88.48%
60- 90	575.358	11.26%
0-90	5098.293	99.73%
90- 180	13.702	0.27%
0- 180	5112.0	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

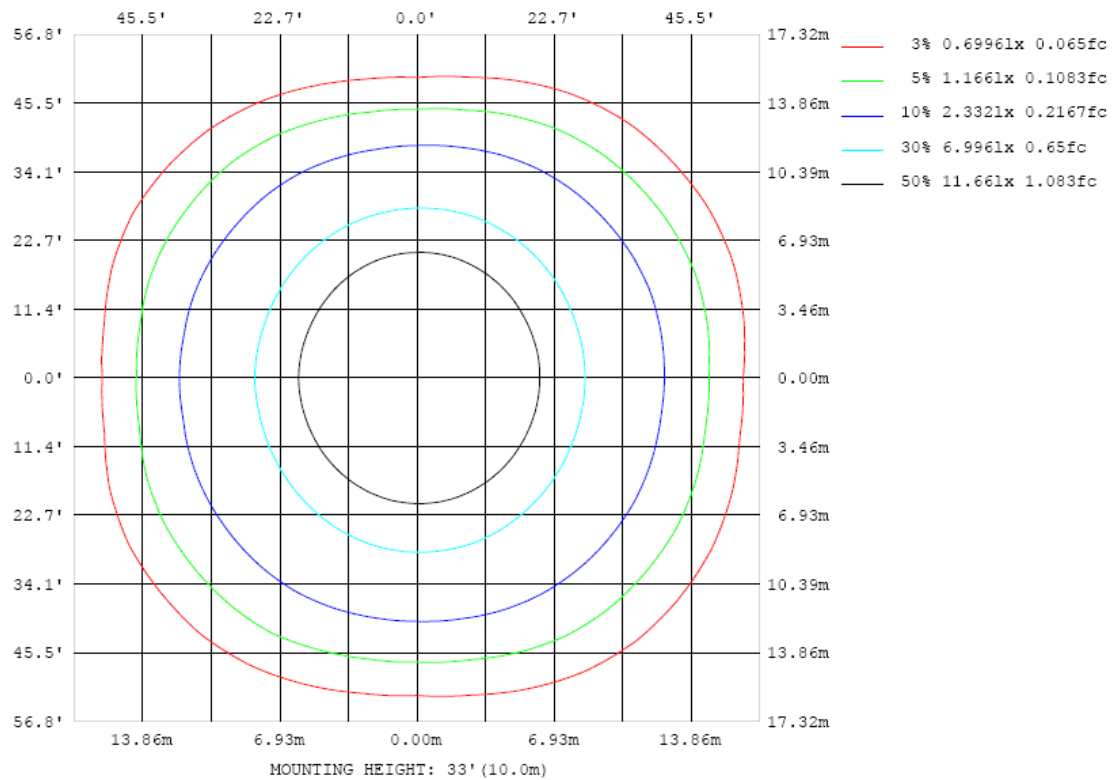


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

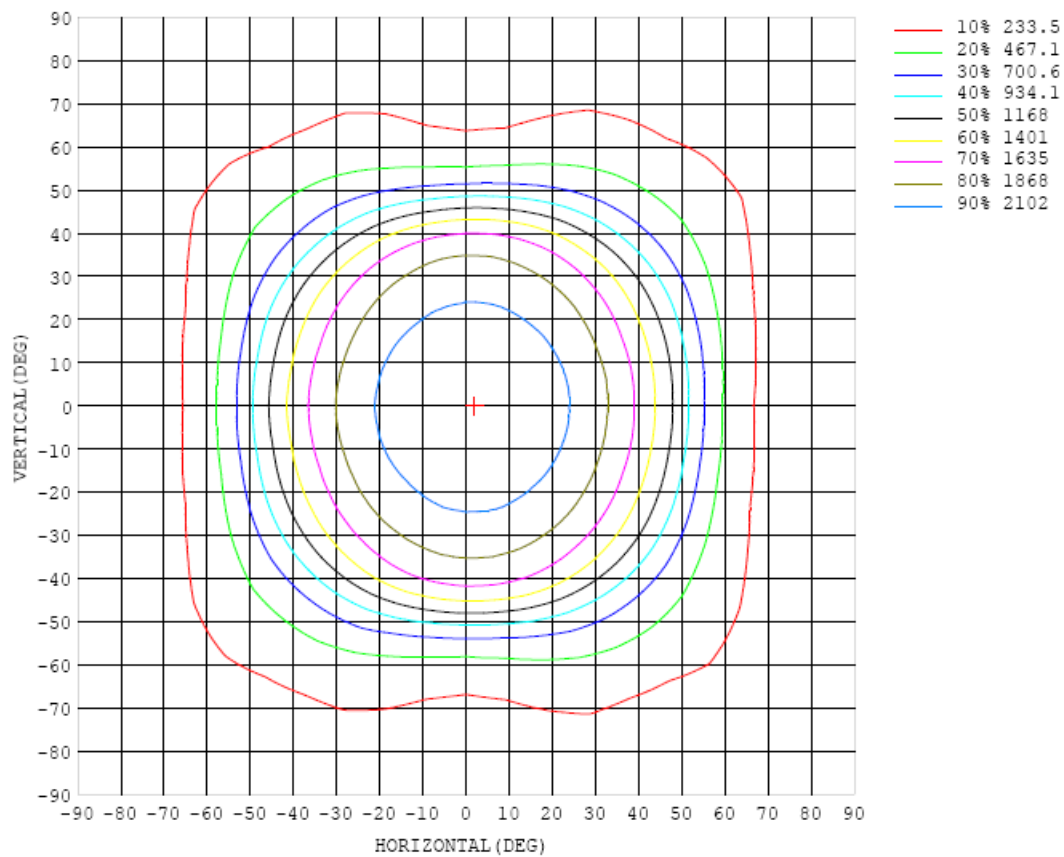


Chart 6: Isocandela Plot

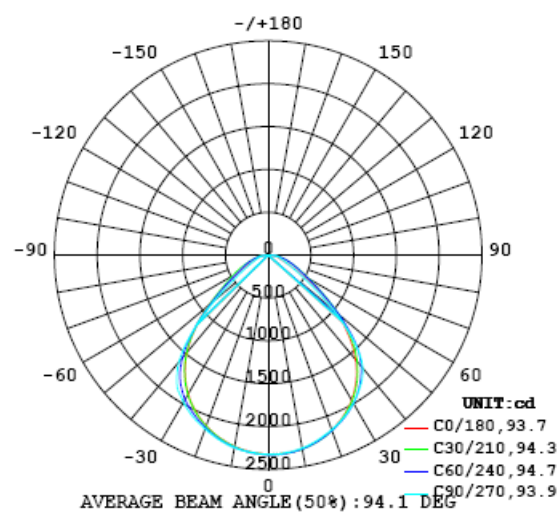


Chart 7: Polar Candela Distribution

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	2327	2327	2327	2327	2327	2327	2327	2327	2327	2327	2327	2327	2327	2327	2327	2327	2327	2327	2327
5	2313	2317	2326	2325	2325	2326	2327	2321	2312	2320	2318	2314	2314	2314	2317	2305	2315	2301	2307
10	2299	2293	2300	2294	2299	2294	2295	2295	2285	2280	2292	2286	2281	2280	2276	2272	2267	2266	2261
15	2242	2250	2252	2251	2247	2247	2247	2240	2239	2235	2233	2224	2223	2220	2217	2213	2211	2207	2209
20	2173	2170	2183	2179	2180	2177	2177	2177	2164	2171	2166	2157	2148	2139	2139	2126	2134	2114	2120
25	2080	2081	2081	2080	2085	2088	2097	2100	2100	2089	2094	2078	2060	2047	2030	2018	2012	2012	2009
30	1948	1953	1962	1964	1970	1986	1996	1995	1995	1993	1983	1971	1953	1932	1909	1886	1875	1871	1875
35	1797	1789	1799	1808	1831	1844	1864	1877	1873	1879	1868	1841	1811	1778	1752	1717	1700	1685	1695
40	1588	1596	1597	1615	1638	1662	1693	1715	1726	1719	1706	1672	1630	1584	1541	1505	1485	1467	1479
45	1342	1333	1353	1374	1393	1417	1439	1441	1428	1416	1403	1389	1362	1320	1286	1253	1224	1199	1212
50	1039	1037	1058	1075	1082	1082	1082	1057	1015	998	997	1009	1016	1001	980	959	936	896	897
55	711	722	759	776	775	774	756	704	653	629	643	677	724	716	707	698	664	608	599
60	440	457	512	546	556	556	530	481	426	396	416	455	492	512	507	502	462	401	381
65	271	296	360	400	402	399	391	351	292	268	287	332	365	366	364	373	338	271	244
70	178	199	266	296	280	285	295	258	213	190	213	252	276	268	259	276	255	190	170
75	132	146	201	216	192	194	214	191	164	148	163	191	206	183	186	199	196	150	139
80	102	116	152	148	123	124	145	137	125	117	125	135	140	119	116	131	139	117	99.1
85	60.0	71.3	83.4	82.3	67.6	68.6	75.9	76.5	71.2	66.4	71.0	73.3	68.3	59.8	55.5	63.9	67.7	59.4	51.4
90	4.64	4.47	5.69	5.62	4.52	3.77	3.03	6.00	4.09	3.31	3.02	2.91	2.60	2.25	3.99	4.24	2.60	2.34	1.02
95	0.61	0.82	0.89	0.95	0.66	0.63	0.55	0.47	0.38	0.36	0.40	0.41	0.49	0.57	0.68	0.83	0.96	0.97	0.75
100	0.76	0.70	1.08	1.72	1.70	1.94	1.75	1.54	1.45	1.40	1.41	1.49	1.66	1.71	1.48	1.44	1.57	1.11	1.43
105	1.13	1.14	1.07	1.50	2.35	2.46	2.25	1.98	1.74	2.00	2.02	1.96	2.06	2.31	2.33	1.31	1.34	1.46	1.59
110	1.27	1.35	1.41	1.45	1.67	2.37	2.67	2.57	2.59	2.52	2.28	2.75	2.81	2.57	2.11	1.36	1.67	1.68	1.60
115	1.61	1.85	1.94	1.84	1.78	1.96	2.17	2.32	2.46	2.48	2.70	2.38	2.25	1.91	1.73	1.56	2.27	1.80	1.95
120	1.96	2.54	1.67	2.23	2.14	2.16	2.04	2.02	2.06	2.10	2.05	1.91	1.91	1.91	2.07	1.78	2.29	2.52	2.11
125	2.18	2.77	1.86	2.78	2.43	2.46	2.47	2.27	2.07	2.04	2.11	2.16	2.27	2.29	2.24	2.35	2.11	3.03	2.23
130	1.48	2.09	2.32	2.43	3.13	2.56	2.74	2.59	2.40	2.52	2.40	2.52	2.61	2.45	3.08	2.81	2.19	3.04	2.44
135	1.73	3.05	3.50	1.62	3.08	3.34	2.96	2.71	2.80	2.79	2.72	2.77	2.85	3.35	3.05	1.58	2.29	2.40	2.50
140	1.83	3.02	3.47	2.91	1.75	3.19	3.30	3.37	3.02	3.31	3.30	3.48	3.60	3.10	1.87	2.20	3.52	3.13	1.72
145	1.75	3.27	3.50	3.58	2.39	1.91	2.73	2.95	3.14	3.02	3.31	3.14	3.08	1.75	1.88	3.38	3.90	3.51	1.77
150	1.95	2.97	3.24	3.61	3.46	2.62	1.72	1.92	2.14	2.49	2.42	1.79	1.70	1.86	2.82	3.78	3.86	3.58	1.88
155	1.99	2.85	3.30	3.62	3.62	2.58	2.81	2.47	2.03	1.93	1.89	2.21	2.90	3.18	3.41	3.03	3.02	3.09	1.99
160	1.82	2.35	2.89	2.85	2.77	3.14	3.59	3.28	3.15	2.91	2.91	3.22	3.57	3.55	3.64	3.18	2.45	2.34	1.88
165	1.79	1.99	2.34	2.77	3.19	3.34	3.27	3.42	3.57	3.31	3.16	3.49	3.39	3.40	2.75	2.46	2.40	2.27	1.88
170	2.06	2.18	2.43	2.84	2.87	3.00	3.09	3.17	3.13	2.93	2.89	2.97	2.52	2.48	2.41	2.49	2.54	2.47	2.12
175	2.32	2.38	2.48	2.68	2.86	2.87	2.79	2.77	2.76	2.72	2.46	2.16	2.22	2.77	2.89	2.84	2.71	2.50	2.30
180	2.34	2.37	2.40	2.41	2.41	2.42	2.32	2.44	2.10	2.29	2.12	2.46	2.61	2.47	2.35	2.04	2.09	2.40	2.32

Table 6: Luminous Intensity Data

Table--2

UNIT: cd

γ C (DEG) (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	2327	2327	2327	2327	2327	2327	2327	2327	2327	2327	2327	2327	2327	2327	2327	2327	2327		
5	2303	2313	2307	2313	2310	2316	2314	2308	2305	2319	2319	2319	2320	2321	2320	2317	2319		
10	2266	2270	2270	2270	2274	2273	2277	2275	2285	2284	2284	2288	2291	2295	2288	2302	2290		
15	2205	2204	2207	2210	2214	2223	2222	2227	2227	2233	2238	2241	2241	2244	2244	2246	2248		
20	2115	2126	2124	2130	2136	2142	2149	2148	2155	2170	2170	2171	2173	2174	2174	2172	2174		
25	2012	2011	2018	2024	2036	2055	2066	2073	2083	2091	2086	2083	2079	2082	2073	2085	2075		
30	1867	1875	1879	1898	1920	1944	1959	1975	1981	1988	1992	1987	1976	1964	1957	1955	1957		
35	1687	1690	1704	1733	1761	1795	1829	1848	1857	1870	1860	1846	1831	1819	1800	1791	1797		
40	1467	1469	1482	1507	1531	1560	1586	1604	1630	1644	1646	1644	1628	1618	1601	1592	1588		
45	1192	1205	1209	1209	1215	1226	1222	1219	1237	1262	1302	1334	1337	1345	1346	1345	1339		
50	892	907	896	886	883	870	837	805	808	843	899	952	987	1012	1040	1053	1048		
55	608	637	643	635	626	590	539	493	480	512	574	640	683	712	738	754	738		
60	401	453	477	463	442	413	374	331	311	335	395	448	487	506	524	519	483		
65	272	335	358	320	314	313	282	236	212	228	284	338	355	365	386	373	320		
70	189	253	255	227	226	241	219	180	155	168	209	250	259	253	275	279	212		
75	148	192	180	158	150	174	164	142	125	133	156	183	174	172	192	208	154		
80	113	131	117	94.0	92.1	108	108	101	92.3	98.0	109	122	110	104	131	149	119		
85	56.2	61.7	51.6	41.4	39.1	41.9	45.4	43.6	42.3	45.2	53.1	56.5	56.2	56.7	72.6	76.1	72.2		
90	2.26	2.60	0.72	1.52	0.90	0.46	0.35	0.27	0.27	0.29	0.31	0.33	0.44	0.64	0.86	1.00	1.57		
95	1.24	1.68	1.01	1.24	1.08	0.71	0.59	0.50	0.44	0.46	0.46	0.52	0.58	0.62	0.81	0.86	0.98		
100	1.46	1.65	1.16	1.78	1.73	1.83	1.81	1.70	1.57	1.65	1.64	1.63	1.49	1.17	1.33	0.95	0.78		
105	1.91	1.87	1.24	1.78	1.59	1.83	2.01	2.06	2.01	1.97	1.90	1.92	1.98	2.30	1.63	1.04	1.22		
110	2.14	1.94	1.32	1.81	1.72	2.02	2.30	2.34	2.34	2.46	2.62	2.51	2.15	1.70	1.42	1.34	1.48		
115	2.54	2.60	1.58	1.81	1.65	1.82	1.82	1.97	2.07	2.08	1.99	1.91	1.72	1.82	1.77	1.74	1.79		
120	2.83	2.09	1.76	2.23	1.94	1.86	1.76	1.78	1.82	1.78	1.83	1.83	2.06	2.16	2.26	1.98	2.62		
125	2.92	2.44	2.02	2.77	2.30	2.42	2.16	2.05	2.00	1.98	2.02	2.39	2.60	2.61	2.96	1.65	2.96		
130	2.87	2.98	1.82	3.52	3.02	2.89	2.86	2.71	2.50	2.49	2.68	2.96	2.89	3.29	3.04	2.57	2.04		
135	2.82	2.37	1.67	3.42	3.87	3.55	3.18	3.21	3.27	3.24	3.38	3.30	3.71	3.73	1.60	3.55	3.25		
140	2.98	3.75	3.46	1.93	3.84	3.95	3.99	3.78	3.84	3.78	4.08	3.92	3.80	1.96	2.84	3.54	3.10		
145	3.31	3.94	4.26	3.56	2.11	2.93	3.97	4.16	4.11	4.15	3.81	2.89	2.05	2.83	3.49	3.62	3.21		
150	3.33	3.83	4.20	3.91	3.04	2.35	2.35	2.44	2.49	2.28	2.17	2.05	2.97	3.45	3.69	3.37	3.07		
155	2.98	3.07	3.11	3.59	4.14	3.75	3.61	2.92	2.54	2.80	3.20	3.34	2.88	3.58	3.81	3.32	3.05		
160	2.05	2.48	2.77	3.44	4.03	4.23	4.16	3.77	3.39	3.83	3.89	4.02	3.83	3.07	2.97	2.81	2.56		
165	1.90	2.28	2.37	2.47	2.87	3.66	3.78	3.65	3.57	3.73	3.90	3.76	3.71	3.40	3.05	2.66	2.14		
170	2.13	2.26	2.52	2.57	2.47	2.46	2.59	3.21	3.11	3.08	3.27	3.20	2.98	2.89	2.75	2.75	2.21		
175	2.30	2.33	2.50	2.72	2.87	2.92	2.46	2.21	2.36	2.77	2.74	2.72	2.70	2.68	2.64	2.39	2.22		
180	2.31	2.36	2.38	2.39	2.40	2.41	2.35	2.37	2.16	2.17	2.20	2.31	2.31	2.35	2.33	2.31	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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