

## 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-L4**

**ULB3-30L-U-50-L4-MWS**

**30LB/3F/850/U/A4**

**30LB/3F/850/U/A4/MWS**

**Laboratory: Leading Testing Laboratories**

**NVLAP CODE: 200960-0**

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Report No.: HZ25030014r

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

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May 28, 2025

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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-L4**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
130.3	5064.7	38.87	0.9965
CCT (K)	CRI	Stabilization Time (Light & Power)	
5202	83.8	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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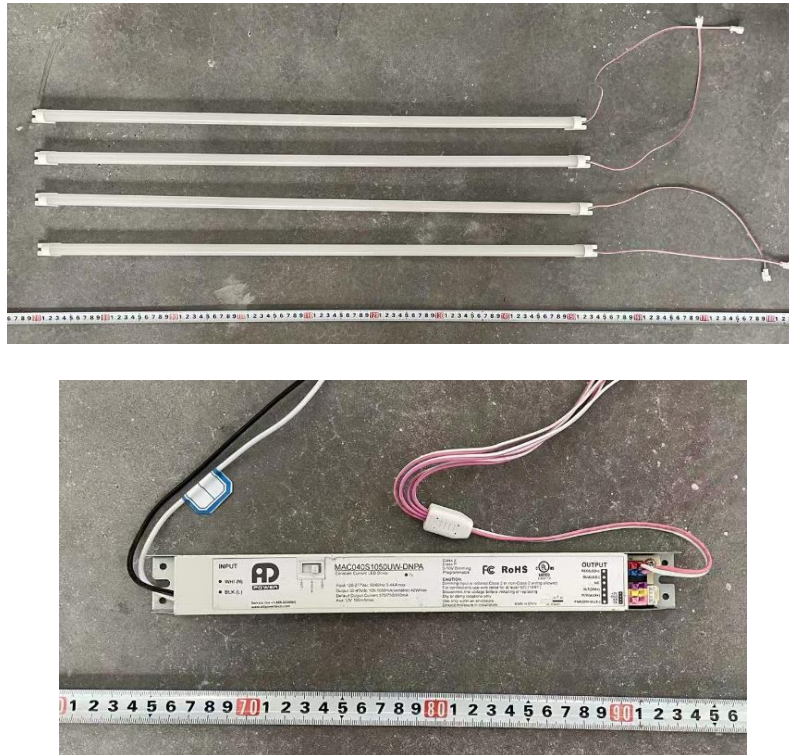


Figure 1- Overview of the sample



Sample in Lithonia 2GT8 lensed 2x4

#### Equipment Under Test(EUT)

<b>Name</b>	: LED Retrofit-kits	
<b>Model</b>	: ULB3-30L-U-50-L4	ULB3-30L-U-50-L4-MWS
	30LB/3F/850/U/A4	30LB/3F/850/U/A4/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)	0.325	0.144
Power Factor	0.9965	0.9638
Test Power (W)	38.87	38.55
THD A%	6.91	13.78
Luminous Efficacy (lm/W)	130.3	131.6
Total Luminous Flux (lm)	5064.7	5072.4
Color Rendering Index (CRI)	83.8	
R9	16	
Correlated Color Temperature (CCT)(K)	5202	
Chromaticity Chroma x	0.3395	
Chromaticity Chroma y	0.3456	
Chromaticity Chroma u	0.2099	
Chromaticity Chroma v	0.3206	
Duv	-0.0007	
Chromaticity Chroma u'	0.2099	
Chromaticity Chroma v'	0.4809	

Special Color Rendering Indices	
R1	83.3
R2	87.9
R3	90.2
R4	84.9
R5	83.9
R6	82.4
R7	87.1
R8	70.8
R9	16
R10	70.6
R11	84.9
R12	61.2
R13	84.4
R14	94.6

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)	0.325
Power Factor	0.9962
Power (W)	38.89
Luminous Efficacy (lm/W)	130.4
Total Luminous Flux (lm)	5072.3
Beam Angle ( ° )	95.0 (0°-180°) / 93.9 (90°-270°)
Center Beam Candle Power (cd)	2300
Maximum Beam Candle Power (cd)	2304 (At: C=340.0, Gamma=0.5)
Spacing Criteria	1.20 (0°-180°) / 1.26 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	88.41%
Zonal Lumens in the 60 °-90 °Zone	11.38%
Zonal Lumens in the 90 °-120 °Zone	0.07%
Zonal Lumens in the 120 °-180 °Zone	0.13%

Table 3: Test data per Goniophotometer Method

### Spectral Power Distribution - Sphere Spectroradiometer Method

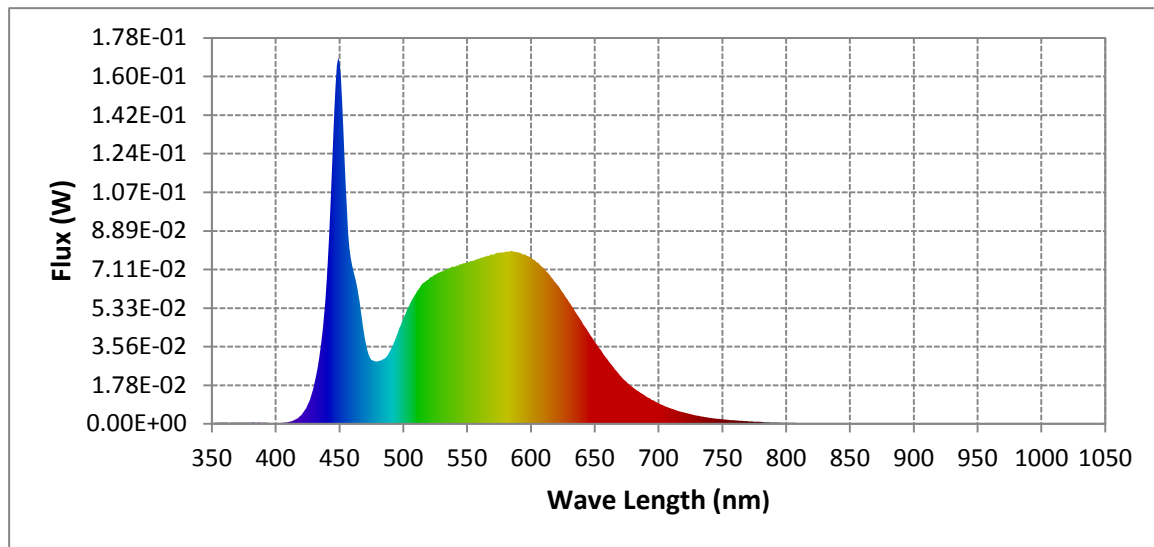


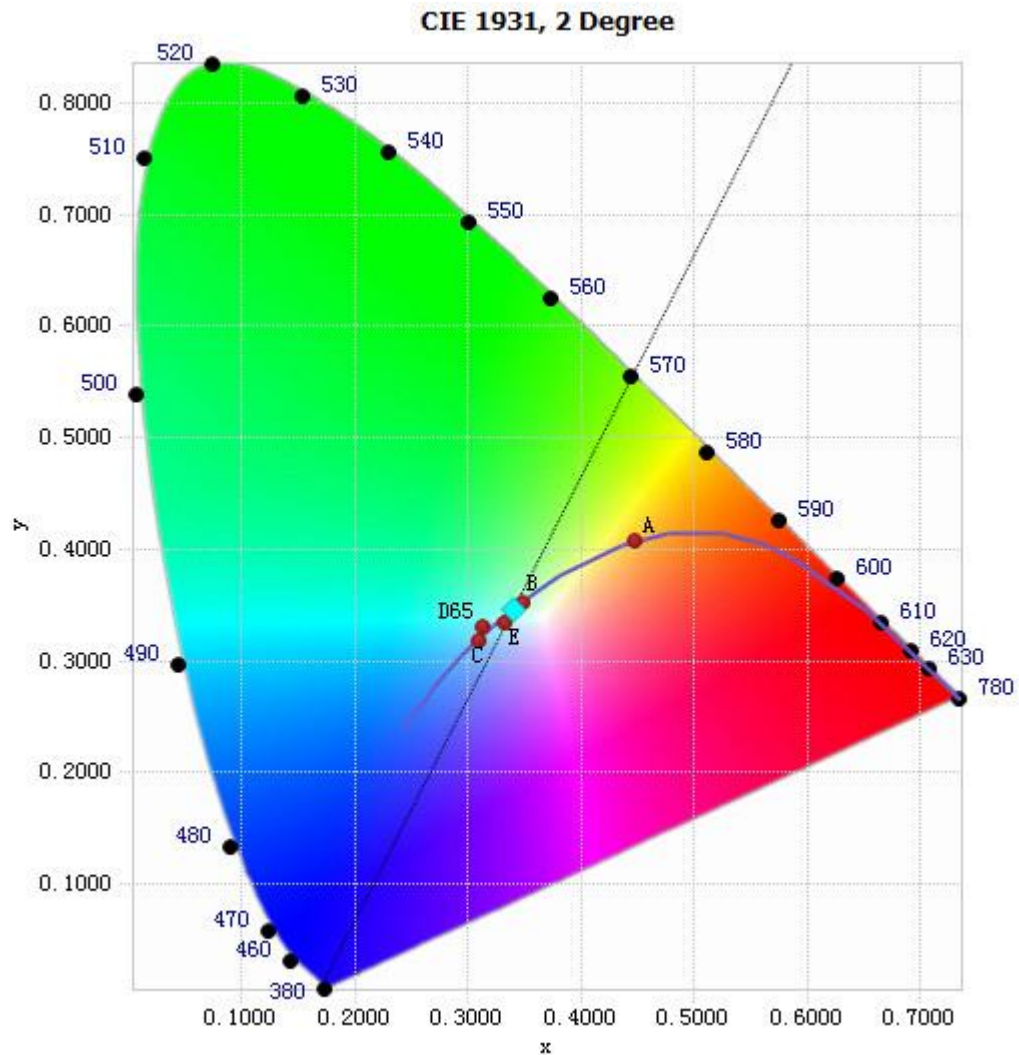
Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	6.43E-04	485	2.99E-02	590	7.92E-02	695	1.11E-02
385	5.43E-04	490	3.38E-02	595	7.81E-02	700	9.56E-03
390	5.18E-04	495	4.08E-02	600	7.65E-02	705	8.21E-03
395	3.98E-04	500	4.84E-02	605	7.42E-02	710	7.03E-03
400	3.60E-04	505	5.47E-02	610	7.16E-02	715	6.03E-03
405	4.38E-04	510	6.01E-02	615	6.85E-02	720	5.18E-03
410	8.21E-04	515	6.44E-02	620	6.46E-02	725	4.44E-03
415	1.82E-03	520	6.66E-02	625	6.05E-02	730	3.78E-03
420	3.93E-03	525	6.87E-02	630	5.61E-02	735	3.26E-03
425	8.58E-03	530	7.03E-02	635	5.15E-02	740	2.79E-03
430	1.74E-02	535	7.12E-02	640	4.71E-02	745	2.41E-03
435	3.39E-02	540	7.24E-02	645	4.24E-02	750	2.10E-03
440	6.57E-02	545	7.34E-02	650	3.79E-02	755	1.82E-03
445	1.30E-01	550	7.40E-02	655	3.38E-02	760	1.57E-03
450	1.67E-01	555	7.51E-02	660	2.97E-02	765	1.36E-03
455	1.08E-01	560	7.61E-02	665	2.58E-02	770	1.19E-03
460	7.34E-02	565	7.70E-02	670	2.22E-02	775	1.00E-03
465	5.97E-02	570	7.79E-02	675	1.92E-02	780	8.93E-04
470	3.97E-02	575	7.86E-02	680	1.67E-02		
475	2.95E-02	580	7.91E-02	685	1.46E-02		
480	2.89E-02	585	7.97E-02	690	1.28E-02		

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



## Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3395, 0.3456)

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

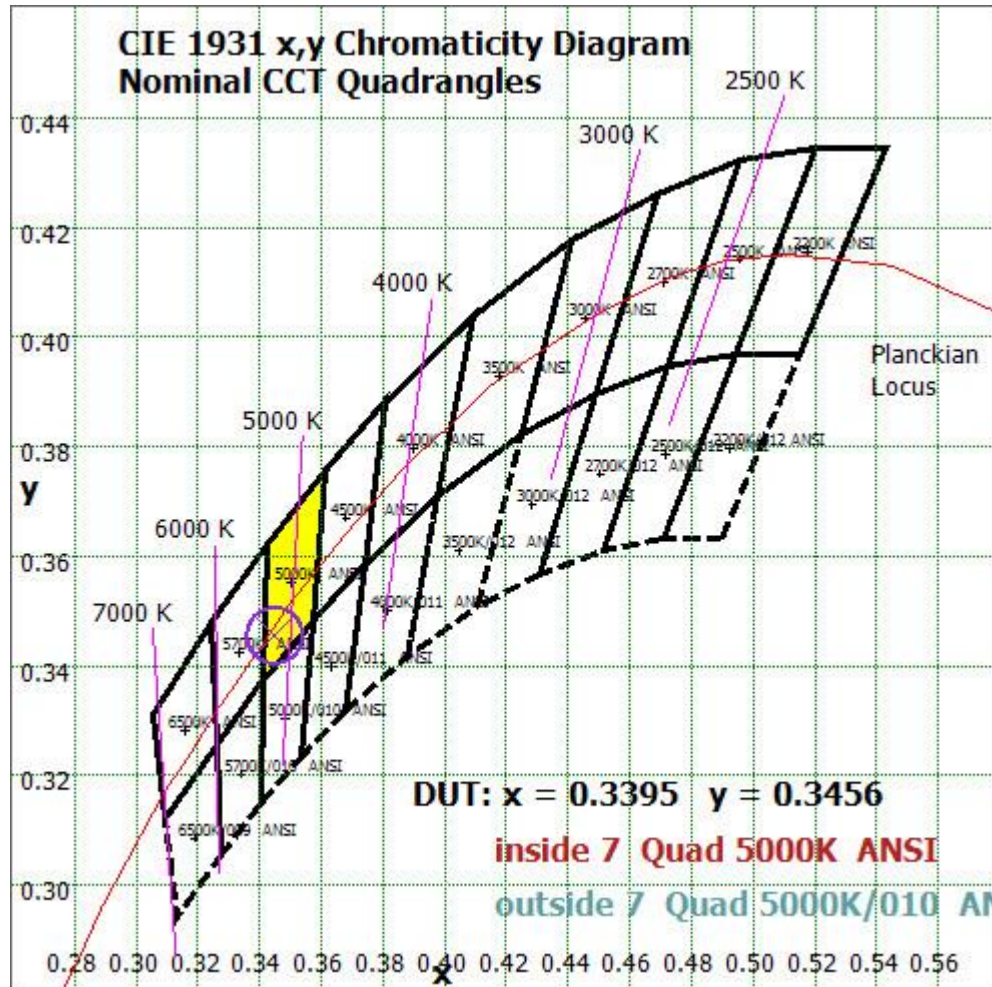
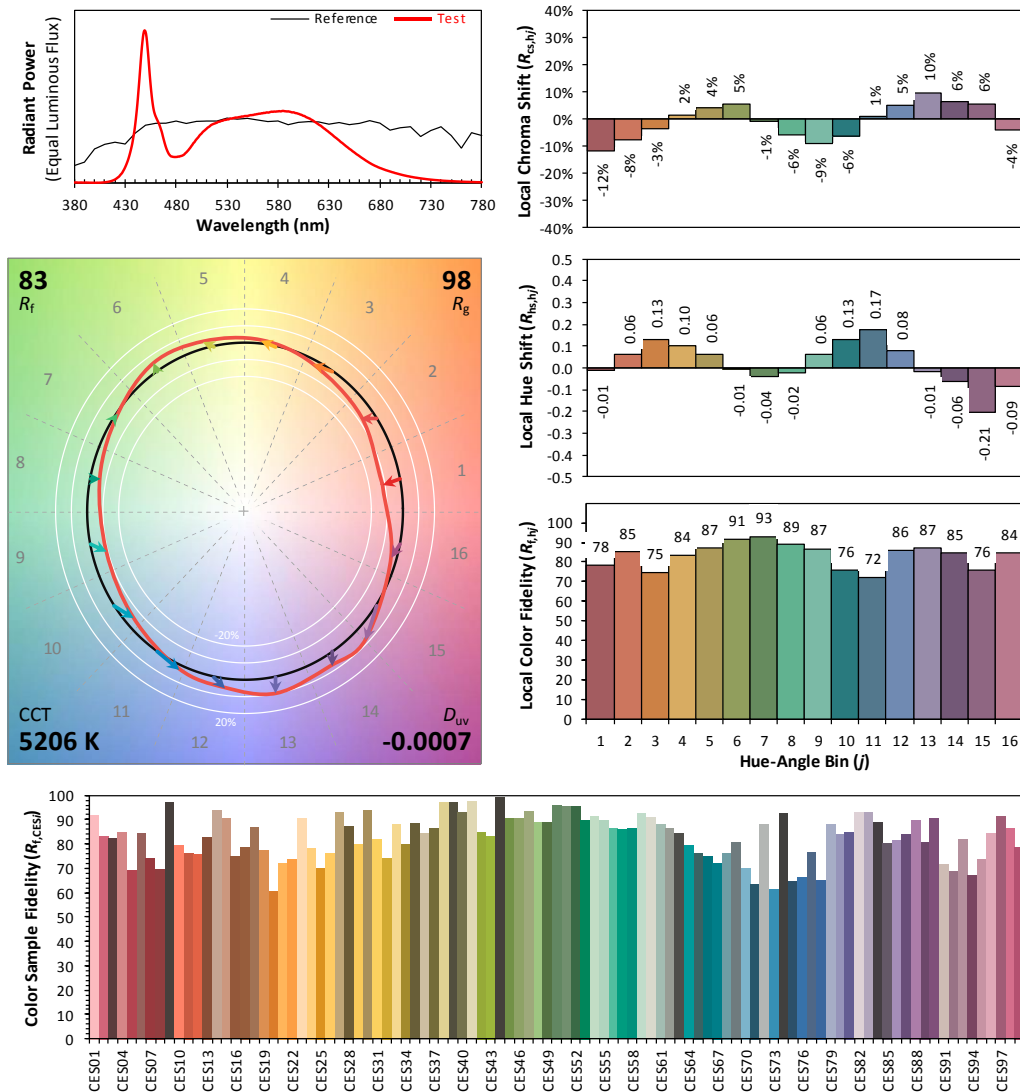


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

**Color Rendition Report – Sphere Spectroradiometer Method****ANSI/IES TM-30-18 Color Rendition Report****Source:** LED**Manufacturer:** Industrial Lighting Products, LLC**Date:** 2025/03/21**Model:** ULB3-30L-U-50-L4

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

$x$  0.3395  
 $y$  0.3456  
 $u'$  0.2099  
 $v'$  0.4809

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	217.401	4.29%
10- 20	621.836	12.26%
20- 30	937.633	18.49%
30- 40	1105.161	21.79%
40- 50	993.831	19.59%
50- 60	608.468	12.00%
60- 70	327.801	6.46%
70- 80	184.1	3.63%
80- 90	65.541	1.29%
90-100	0.943	0.02%
100-110	1.513	0.03%
110-120	1.317	0.03%
120-130	1.568	0.03%
130-140	1.739	0.03%
140-150	1.479	0.03%
150-160	1.08	0.02%
160-170	0.664	0.01%
170-180	0.201	0.00%
Total	5072.3	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	4484.33	88.41%
60- 90	577.442	11.38%
0-90	5061.772	99.79%
90- 180	10.504	0.21%
0- 180	5072.3	100%

Table 5: Zonal Lumen

### Illuminance Plots- Goniophotometer Method

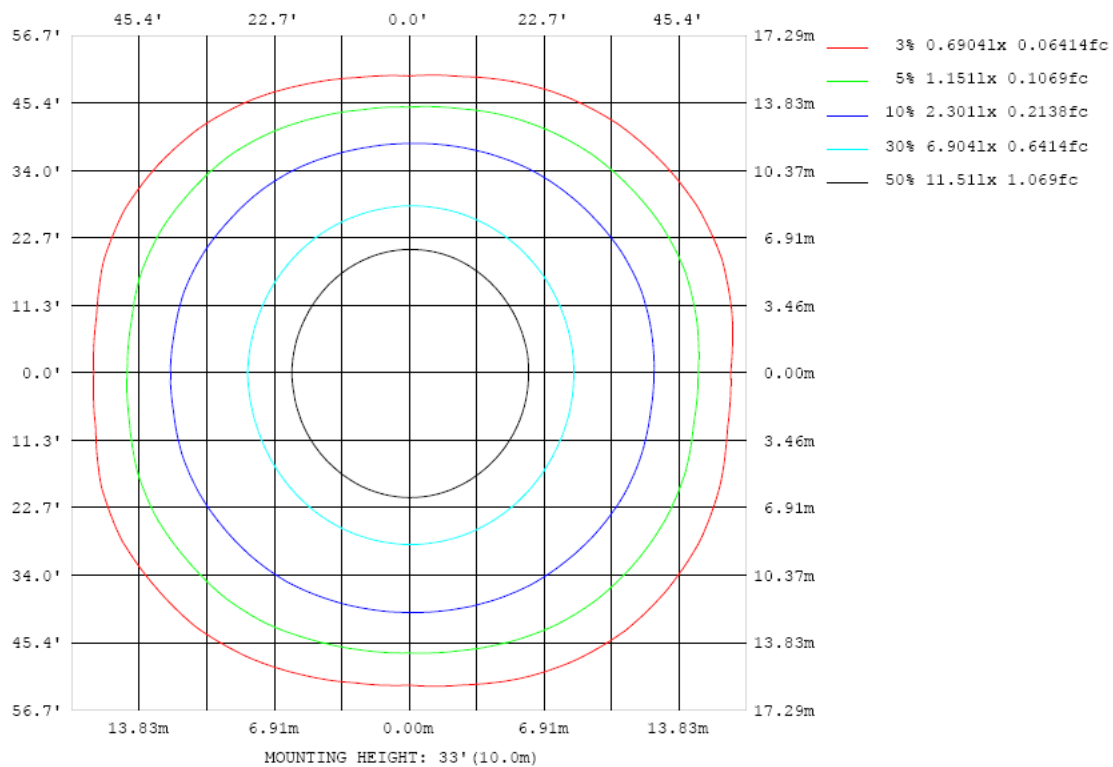


Chart 5: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

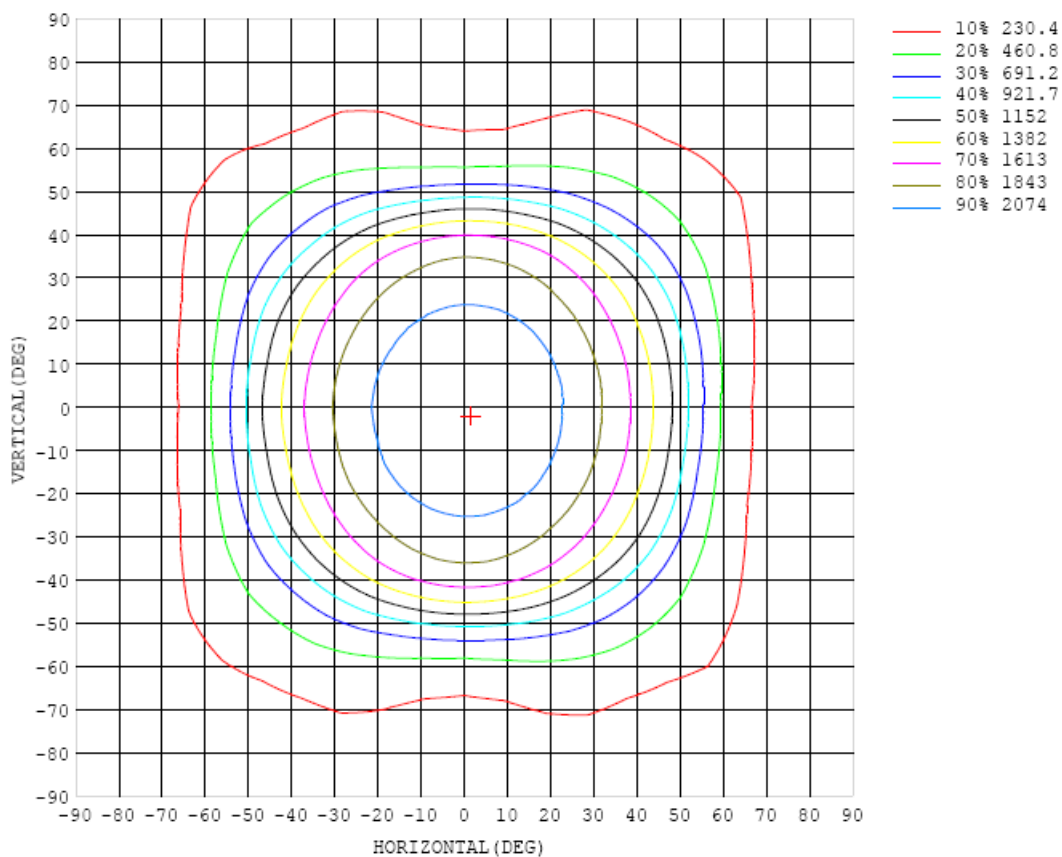


Chart 6: Isocandela Plot

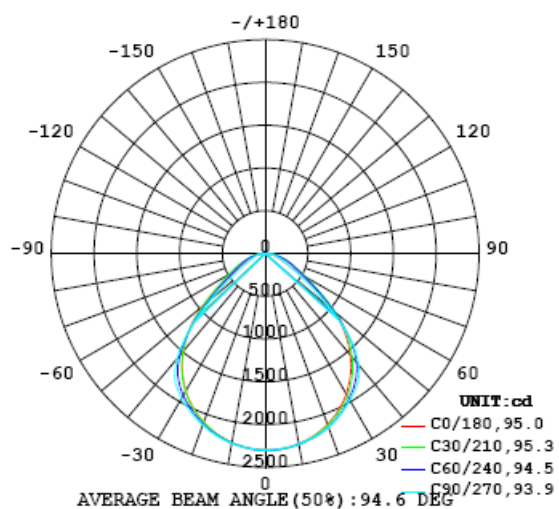


Chart 7: Polar Candela Distribution

## 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	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300
5	2287	2291	2294	2293	2288	2295	2290	2293	2294	2288	2291	2291	2288	2279	2277	2287	2293	2290	2281
10	2263	2260	2265	2262	2263	2260	2272	2261	2267	2264	2261	2259	2257	2254	2248	2248	2250	2248	2243
15	2203	2210	2211	2212	2207	2222	2220	2225	2226	2222	2222	2221	2214	2197	2194	2191	2191	2189	2187
20	2130	2128	2135	2138	2147	2152	2158	2164	2167	2159	2158	2151	2141	2134	2119	2114	2110	2100	2097
25	2022	2029	2036	2041	2049	2065	2079	2075	2079	2080	2075	2066	2057	2034	2026	2012	2000	1995	1995
30	1898	1903	1911	1924	1936	1951	1959	1974	1985	1980	1974	1962	1940	1921	1899	1884	1876	1856	1854
35	1737	1743	1759	1769	1781	1803	1833	1857	1868	1870	1863	1839	1813	1772	1739	1720	1702	1691	1692
40	1551	1558	1564	1577	1603	1635	1664	1678	1701	1701	1690	1666	1631	1591	1552	1520	1501	1487	1493
45	1321	1324	1336	1354	1367	1378	1394	1398	1397	1386	1367	1355	1324	1299	1281	1266	1244	1252	
50	1042	1037	1061	1071	1061	1049	1041	1021	998	980	983	990	1007	1000	991	998	988	954	958
55	715	718	758	770	762	752	731	685	648	626	638	663	702	719	720	721	708	664	640
60	432	447	505	540	546	543	517	475	421	389	407	448	486	514	514	521	492	426	404
65	266	284	353	395	395	391	385	348	288	262	278	321	363	370	368	384	359	288	256
70	173	191	256	293	274	275	291	258	207	186	203	243	279	272	263	283	269	200	173
75	128	140	194	215	189	187	209	191	157	145	152	188	206	187	186	202	204	158	142
80	100	113	150	145	123	121	138	136	119	112	116	134	139	123	115	135	146	130	105
85	62.7	73.4	85.3	81.3	66.7	64.9	72.1	73.0	65.2	61.8	64.9	70.5	67.9	62.0	55.3	68.3	76.5	68.5	59.5
90	3.44	1.81	3.79	3.75	3.13	2.68	6.06	4.34	3.61	2.91	2.65	2.79	2.98	2.88	2.43	2.34	0.67	4.22	1.40
95	0.58	0.69	0.87	0.81	0.64	0.49	0.42	0.35	0.28	0.26	0.27	0.29	0.35	0.40	0.52	0.64	0.83	0.97	0.73
100	0.53	0.53	0.68	1.57	1.72	1.77	1.90	1.58	1.47	1.50	1.48	1.30	1.23	1.05	1.11	1.15	0.97	1.06	1.74
105	0.79	0.91	0.85	1.02	1.19	1.90	2.36	2.16	1.95	1.97	1.88	1.57	1.50	1.22	1.11	1.00	1.12	1.22	1.55
110	1.03	1.36	1.13	1.21	1.30	1.15	1.09	1.25	1.41	1.55	1.44	1.06	0.98	1.00	1.16	1.12	1.36	1.34	1.39
115	1.36	1.68	1.51	1.50	1.47	1.35	1.28	1.14	1.08	1.05	1.05	1.00	1.05	1.09	1.21	1.15	1.63	1.34	1.54
120	1.75	2.01	1.34	1.94	1.78	1.59	1.53	1.26	1.18	1.16	1.15	1.12	1.22	1.32	1.38	1.34	1.73	1.94	1.59
125	1.81	2.06	1.55	2.34	2.24	1.93	1.86	1.71	1.42	1.38	1.37	1.40	1.48	1.58	1.64	1.49	1.41	2.14	1.70
130	1.13	1.55	2.59	1.83	2.89	2.35	2.23	2.16	1.88	1.74	1.73	1.79	1.79	1.82	2.01	1.78	1.45	1.78	1.66
135	1.34	2.68	2.96	1.24	2.87	3.13	2.57	2.37	2.29	2.23	2.11	2.03	2.10	2.16	2.17	1.36	1.62	2.03	1.81
140	1.47	2.86	2.88	3.04	1.37	3.01	3.04	2.82	2.71	2.58	2.44	2.28	2.40	2.22	1.36	1.48	2.16	2.09	1.43
145	1.38	2.54	2.89	3.08	2.56	1.49	2.55	2.60	2.55	2.42	2.36	2.38	2.24	1.36	1.58	2.12	2.30	2.19	1.50
150	1.52	2.61	2.90	3.22	3.51	2.14	1.41	1.46	1.86	2.06	1.93	1.38	1.35	1.52	2.21	2.42	2.25	2.21	1.63
155	1.68	2.58	3.01	3.16	2.50	2.36	3.34	2.63	1.78	1.48	1.47	1.78	1.94	2.05	2.04	2.16	2.30	2.22	1.72
160	1.56	1.76	2.21	2.25	2.66	3.22	3.41	3.14	2.88	2.56	2.53	2.39	2.26	2.27	2.39	2.16	1.94	1.94	1.68
165	1.67	1.83	2.33	2.60	2.76	2.81	2.89	2.75	2.60	2.47	2.38	2.36	2.27	2.34	2.20	2.00	2.00	1.93	1.63
170	1.82	1.90	2.10	2.41	2.50	2.43	2.49	2.46	2.46	2.36	2.32	2.35	2.05	1.99	1.97	2.05	2.09	1.99	1.75
175	1.96	2.01	2.07	2.16	2.25	2.25	2.19	2.25	2.24	2.22	2.16	1.95	2.01	2.23	2.25	2.22	2.12	2.05	1.90
180	1.94	1.98	1.99	2.01	1.90	1.90	1.87	1.93	1.77	1.79	1.90	1.94	1.92	1.97	1.87	1.90	1.88	1.88	1.92

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	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300		
5	2283	2287	2283	2279	2281	2290	2281	2290	2285	2289	2289	2287	2282	2282	2292	2301	2296		
10	2246	2246	2246	2246	2252	2247	2256	2252	2251	2257	2258	2260	2259	2255	2261	2263	2266		
15	2186	2186	2186	2182	2187	2198	2193	2207	2207	2206	2207	2204	2200	2206	2207	2215	2212		
20	2099	2101	2101	2108	2116	2122	2126	2130	2132	2139	2141	2141	2136	2124	2129	2133	2135		
25	1991	1991	1995	1998	2014	2025	2038	2050	2052	2052	2054	2045	2038	2039	2035	2033	2030		
30	1857	1858	1865	1877	1893	1918	1929	1947	1958	1960	1954	1945	1929	1912	1908	1909	1908		
35	1684	1687	1696	1714	1746	1775	1804	1827	1833	1835	1826	1806	1784	1763	1757	1749	1745		
40	1482	1483	1493	1510	1531	1555	1572	1587	1604	1611	1608	1606	1591	1575	1560	1558	1558		
45	1238	1244	1242	1229	1230	1231	1213	1215	1231	1245	1263	1289	1297	1305	1325	1325	1324		
50	944	958	941	910	896	874	838	813	811	833	872	920	952	986	1030	1058	1053		
55	646	677	674	651	638	597	545	501	485	512	565	616	661	694	734	760	746		
60	422	475	496	478	454	419	375	333	312	332	388	434	471	496	521	520	484		
65	282	348	375	333	322	322	283	237	213	224	277	335	348	359	379	376	320		
70	194	258	270	235	231	248	225	178	156	163	205	252	255	249	271	280	213		
75	151	198	187	167	156	177	169	137	125	128	154	183	174	169	190	208	157		
80	118	142	123	98.7	96.3	111	112	101	91.6	94.3	108	122	112	100	131	150	124		
85	64.1	70.7	59.1	45.5	42.2	46.3	49.0	46.5	42.8	45.7	53.9	58.0	57.7	56.5	73.2	78.0	77.3		
90	1.53	4.64	0.54	0.71	0.58	0.37	0.25	0.19	0.18	0.20	0.22	0.27	0.32	0.61	0.84	0.87	0.97		
95	0.95	1.20	0.89	1.10	0.87	0.59	0.43	0.36	0.34	0.36	0.37	0.42	0.49	0.56	0.67	0.86	0.98		
100	1.55	2.35	1.01	1.55	1.39	1.16	1.15	1.25	1.60	1.55	1.50	1.47	1.36	1.48	1.53	0.68	0.63		
105	1.77	2.30	1.08	1.35	1.39	1.55	1.59	1.93	2.02	1.92	2.07	2.15	2.00	1.39	1.05	0.78	1.07		
110	1.71	1.78	1.02	1.40	1.25	1.12	1.08	1.28	1.42	1.44	1.26	1.16	1.23	1.26	1.25	0.91	1.17		
115	1.82	1.77	1.11	1.37	1.31	1.18	1.07	1.09	1.10	1.12	1.11	1.27	1.37	1.53	1.63	1.10	1.73		
120	1.94	1.51	1.33	1.54	1.40	1.30	1.26	1.24	1.26	1.30	1.42	1.52	1.79	1.79	2.02	1.23	2.35		
125	2.00	1.71	1.52	1.99	1.58	1.52	1.51	1.45	1.48	1.59	1.74	2.18	2.04	2.27	2.59	1.05	2.09		
130	1.84	2.14	1.39	2.21	1.99	1.82	1.83	1.87	1.92	2.08	2.36	2.47	2.65	3.19	2.64	2.58	1.61		
135	2.23	1.96	1.35	2.12	2.36	2.24	2.20	2.29	2.46	2.62	2.64	2.96	3.43	3.10	1.36	3.03	2.84		
140	2.02	2.32	2.13	1.53	2.48	2.53	2.78	2.66	2.92	3.09	3.13	3.23	3.20	1.56	2.89	3.10	2.84		
145	2.19	2.39	2.50	2.30	1.70	2.13	2.65	2.89	2.86	3.08	2.84	2.65	1.60	2.52	3.11	2.85	2.50		
150	2.16	2.37	2.52	2.53	2.24	1.72	1.88	2.05	2.18	2.02	1.69	1.70	2.14	3.43	3.25	2.93	2.65		
155	2.07	2.24	2.38	2.42	2.44	2.41	2.37	2.25	2.04	2.35	3.10	3.47	2.76	2.38	2.81	2.94	2.65		
160	1.77	1.96	2.03	2.24	2.61	2.53	2.44	2.61	2.69	2.95	3.28	3.24	3.23	3.02	2.49	2.27	2.05		
165	1.66	1.89	1.95	2.00	2.21	2.42	2.53	2.52	2.48	2.55	2.64	2.79	2.81	2.77	2.57	2.43	2.08		
170	1.75	1.85	2.01	2.02	1.97	2.00	2.10	2.30	2.28	2.30	2.33	2.25	2.28	2.24	2.37	2.31	1.97		
175	1.91	1.95	2.03	2.15	2.22	2.22	2.07	1.96	1.97	2.10	2.10	2.13	2.03	2.08	2.11	2.01	1.95		
180	1.92	1.96	1.98	1.99	1.99	2.00	1.99	1.98	1.87	1.85	1.86	1.93	1.94	1.95	1.93	1.92	1.93		

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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