

## 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-35-L2**

**ULB3-30L-U-35-L2-MWS**

**30LB/3F/835/U/A2**

**30LB/3F/835/U/A2/MWS**

**Laboratory: Leading Testing Laboratories**

**NVLAP CODE: 200960-0**

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Report No.: HZ25030014j

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*

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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-35-L2**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
127.9	4126.5	32.26	0.9953
CCT (K)	CRI	Stabilization Time (Light & Power)	
3510	82.8	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. 20, 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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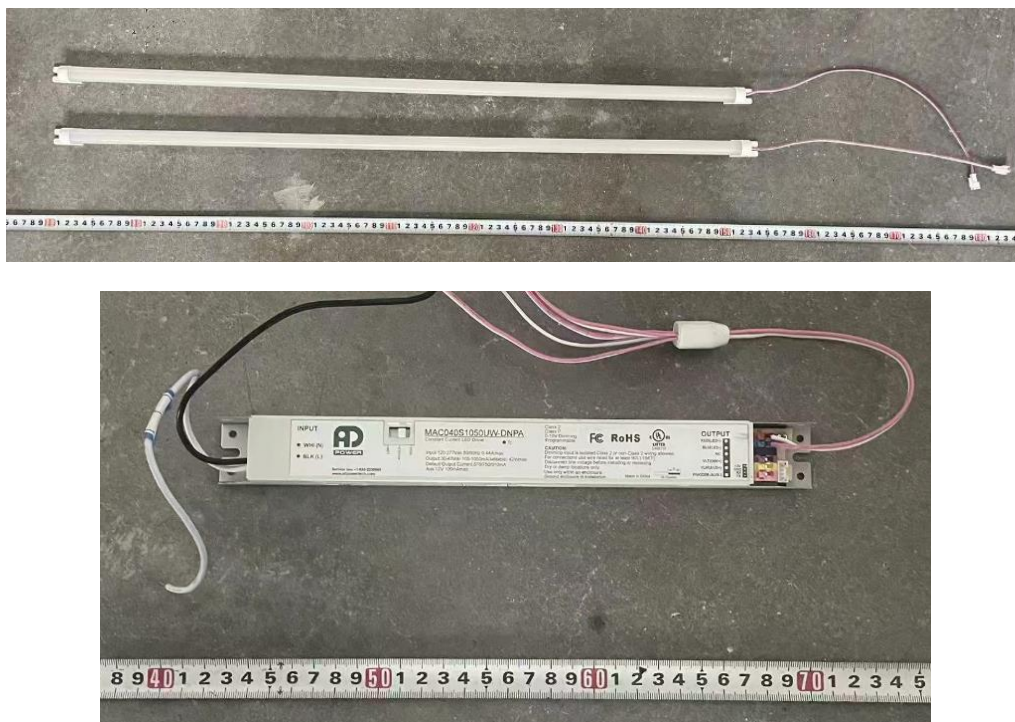


Figure 1- Overview of the sample



Sample in Lithonia 2GT8 lensed 2x4

#### Equipment Under Test(EUT)

<b>Name</b>	: LED Retrofit-kits	
<b>Model</b>	: ULB3-30L-U-35-L2	ULB3-30L-U-35-L2-MWS
	30LB/3F/835/U/A2	30LB/3F/835/U/A2/MWS
<b>Electrical Ratings</b>	: 120-277V, 50/60Hz	
<b>Product Description</b>	: Field-Adjustable 33W/25W/18W, 3500K 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	0.9953	0.9542
Test Power (W)	32.26	32.32
THD A%	6.47	12.87
Luminous Efficacy (lm/W)	127.9	128.1
Total Luminous Flux (lm)	4126.5	4138.8
Color Rendering Index (CRI)	82.8	
R9	9.8	
Correlated Color Temperature (CCT)(K)	3510	
Chromaticity Chroma x	0.4032	
Chromaticity Chroma y	0.3864	
Chromaticity Chroma u	0.2361	
Chromaticity Chroma v	0.3394	
Duv	-0.0014	
Chromaticity Chroma u'	0.2361	
Chromaticity Chroma v'	0.5091	

Special Color Rendering Indices	
R1	81.4
R2	89.2
R3	95
R4	81.8
R5	81.4
R6	85.4
R7	84.8
R8	63.1
R9	9.8
R10	74.6
R11	81.1
R12	64.2
R13	83.2
R14	97.3

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	0.9955
Power (W)	32.28
Luminous Efficacy (lm/W)	128.2
Total Luminous Flux (lm)	4139.0
Beam Angle ( ° )	95.4 (0°-180°) / 95.6 (90°-270°)
Center Beam Candle Power (cd)	1856
Maximum Beam Candle Power (cd)	1861 (At: C=190.0, Gamma=0.5)
Spacing Criteria	1.21 (0°-180°) / 1.26 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	88.28%
Zonal Lumens in the 60 °-90 °Zone	11.49%
Zonal Lumens in the 90 °-120 °Zone	0.08%
Zonal Lumens in the 120 °-180 °Zone	0.15%

Table 3: Test data per Goniophotometer Method

### Spectral Power Distribution - Sphere Spectroradiometer Method

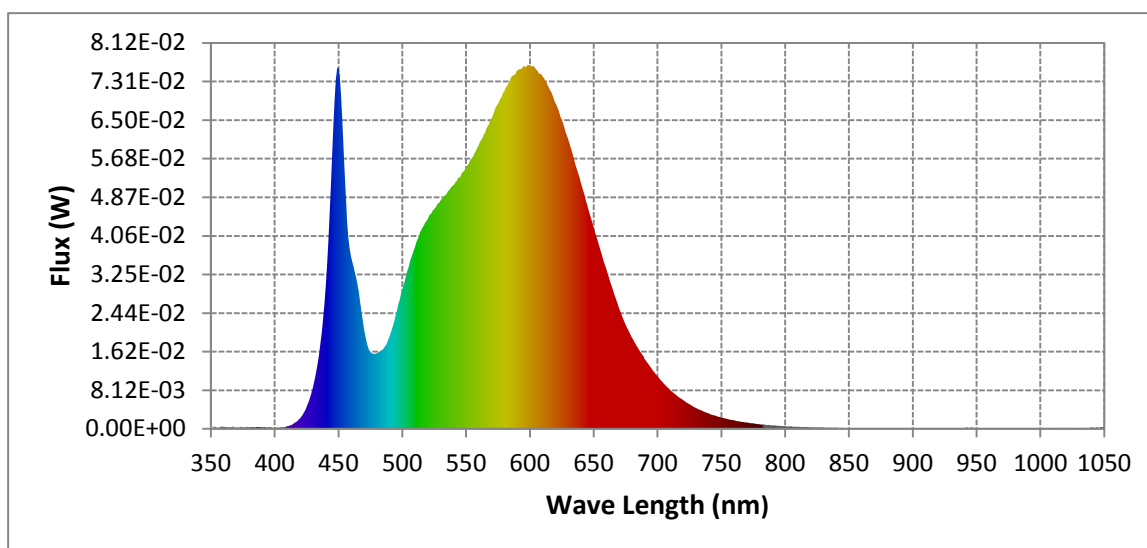


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	3.63E-04	485	1.68E-02	590	7.54E-02	695	1.29E-02
385	3.26E-04	490	1.94E-02	595	7.63E-02	700	1.11E-02
390	2.88E-04	495	2.40E-02	600	7.65E-02	705	9.54E-03
395	2.86E-04	500	2.92E-02	605	7.55E-02	710	8.21E-03
400	2.31E-04	505	3.40E-02	610	7.40E-02	715	7.03E-03
405	2.77E-04	510	3.82E-02	615	7.18E-02	720	6.06E-03
410	5.42E-04	515	4.19E-02	620	6.86E-02	725	5.18E-03
415	1.09E-03	520	4.41E-02	625	6.50E-02	730	4.41E-03
420	2.17E-03	525	4.62E-02	630	6.10E-02	735	3.81E-03
425	4.51E-03	530	4.81E-02	635	5.64E-02	740	3.24E-03
430	8.68E-03	535	4.95E-02	640	5.18E-02	745	2.78E-03
435	1.60E-02	540	5.12E-02	645	4.71E-02	750	2.37E-03
440	2.98E-02	545	5.28E-02	650	4.24E-02	755	2.07E-03
445	5.71E-02	550	5.47E-02	655	3.78E-02	760	1.79E-03
450	7.60E-02	555	5.70E-02	660	3.35E-02	765	1.51E-03
455	5.31E-02	560	5.96E-02	665	2.93E-02	770	1.32E-03
460	3.63E-02	565	6.23E-02	670	2.53E-02	775	1.14E-03
465	3.05E-02	570	6.53E-02	675	2.19E-02	780	9.62E-04
470	2.14E-02	575	6.82E-02	680	1.92E-02		
475	1.61E-02	580	7.10E-02	685	1.68E-02		
480	1.59E-02	585	7.38E-02	690	1.47E-02		

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



## Chromaticity Diagram - Sphere Spectroradiometer Method

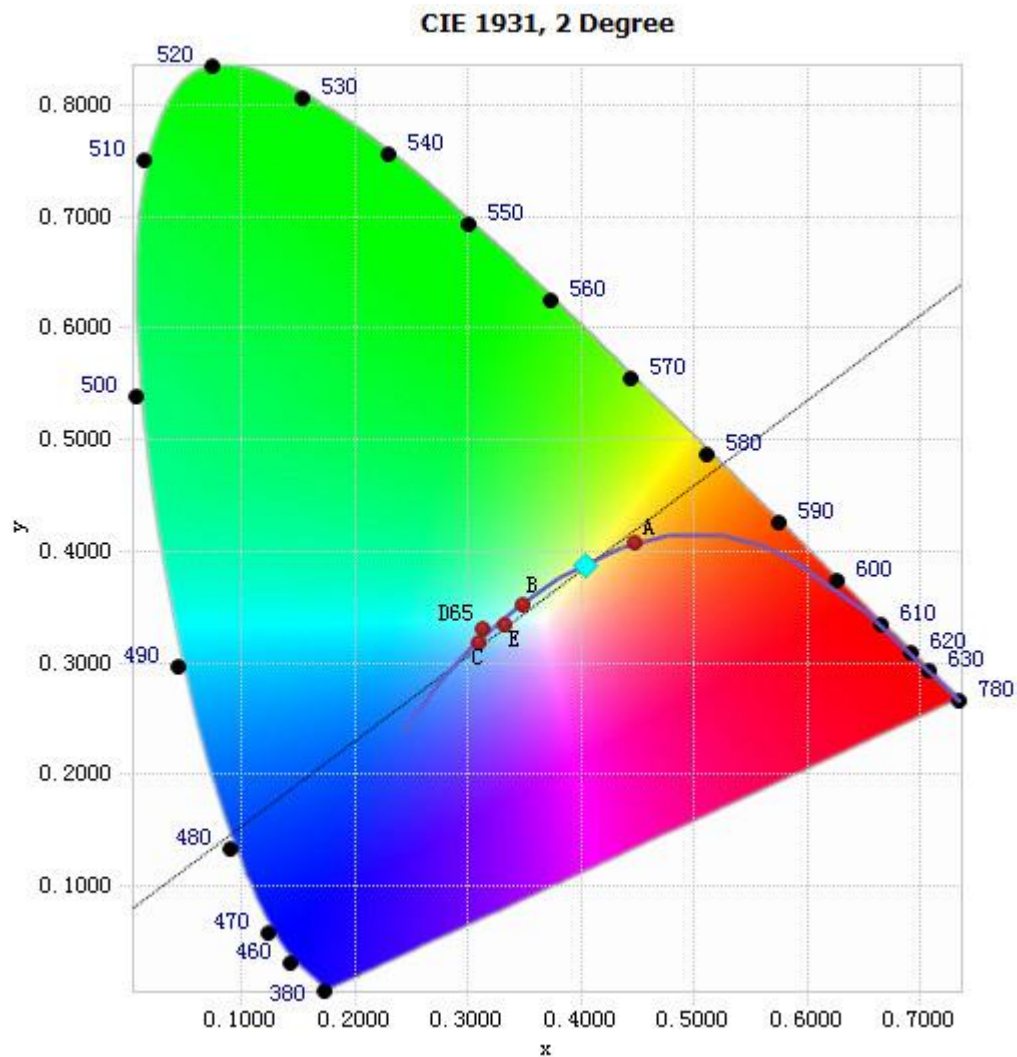


Chart 2: Chromaticity Diagram per Sphere - Spectroradiometer Method

Note: The location on the diagram of the tristimulus coordinates are indicated by the blue diamond.



### Nominal CCT Quadrangles – Sphere Spectroradiometer Method

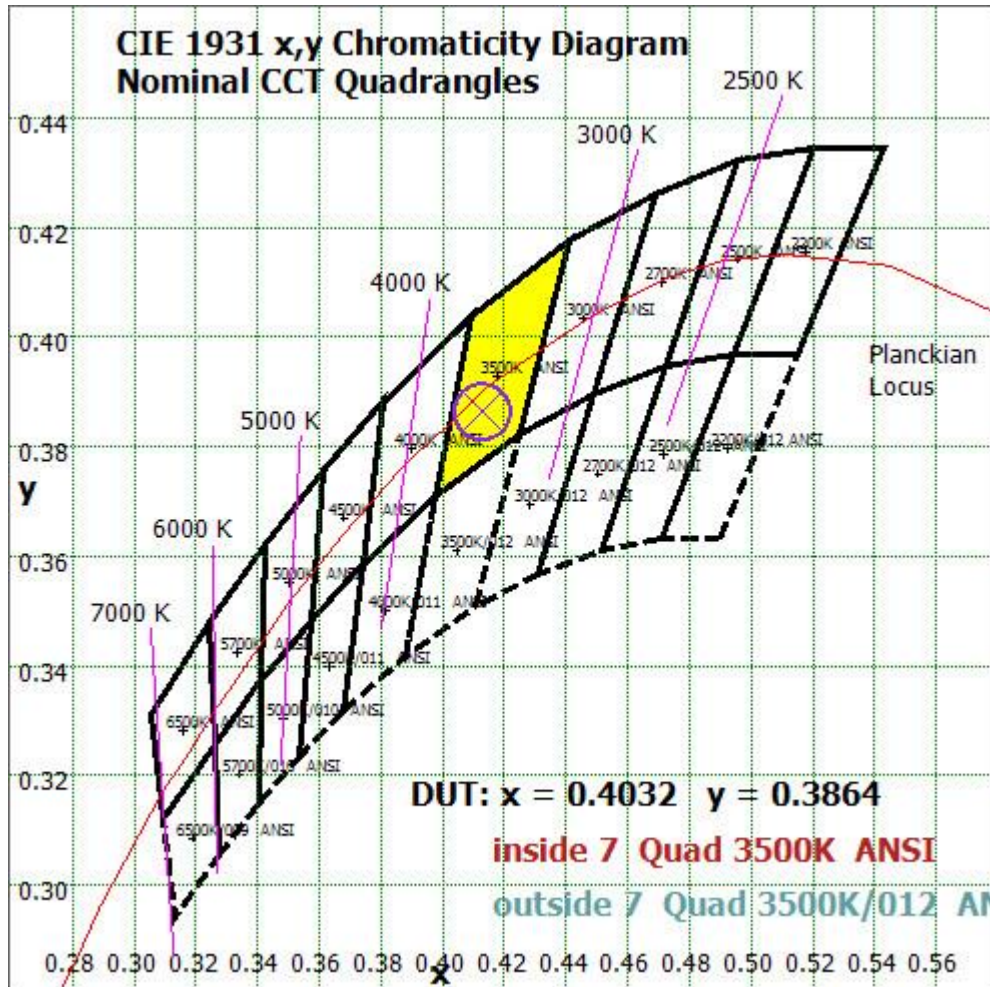


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram



Quality Assured  
Color Rendition Report – Sphere Spectroradiometer Method

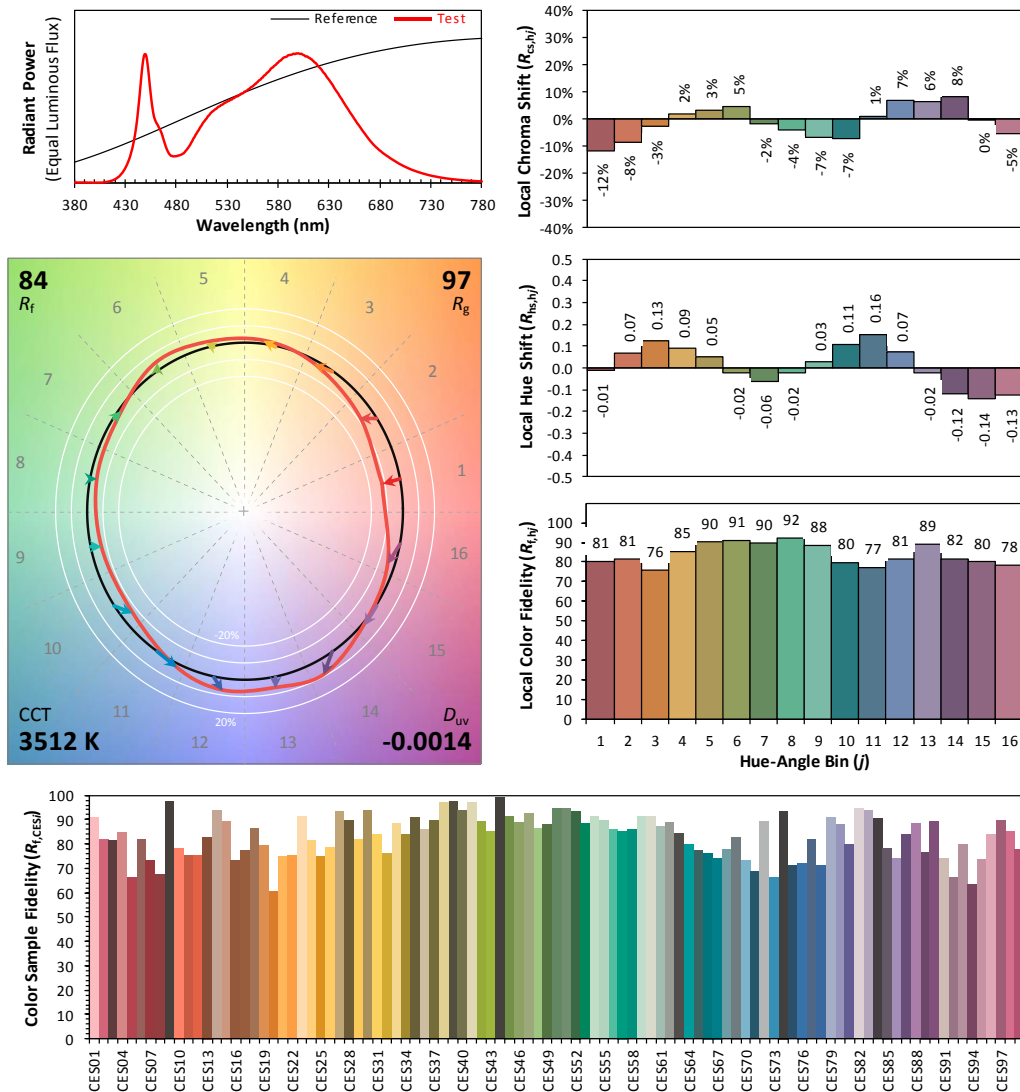
## ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: Industrial Lighting Products, LLC

Date: 2025/03/20

Model: ULB3-30L-U-35-L2



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

$x$  0.4032  
 $y$  0.3864  
 $u'$  0.2361  
 $v'$  0.5091

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	175.676	4.24%
10- 20	503.209	12.16%
20- 30	757.523	18.30%
30- 40	892.704	21.57%
40- 50	820.72	19.83%
50- 60	504.024	12.18%
60- 70	270.177	6.53%
70- 80	151.154	3.65%
80- 90	54.294	1.31%
90-100	0.889	0.02%
100-110	1.313	0.03%
110-120	1.127	0.03%
120-130	1.355	0.03%
130-140	1.55	0.04%
140-150	1.421	0.03%
150-160	1.071	0.03%
160-170	0.64	0.02%
170-180	0.177	0.00%
Total	4139.0	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	3653.856	88.28%
60- 90	475.625	11.49%
0-90	4129.481	99.77%
90- 180	9.543	0.23%
0- 180	4139.0	100%

Table 5: Zonal Lumen

## Illuminance Plots- Goniophotometer Method

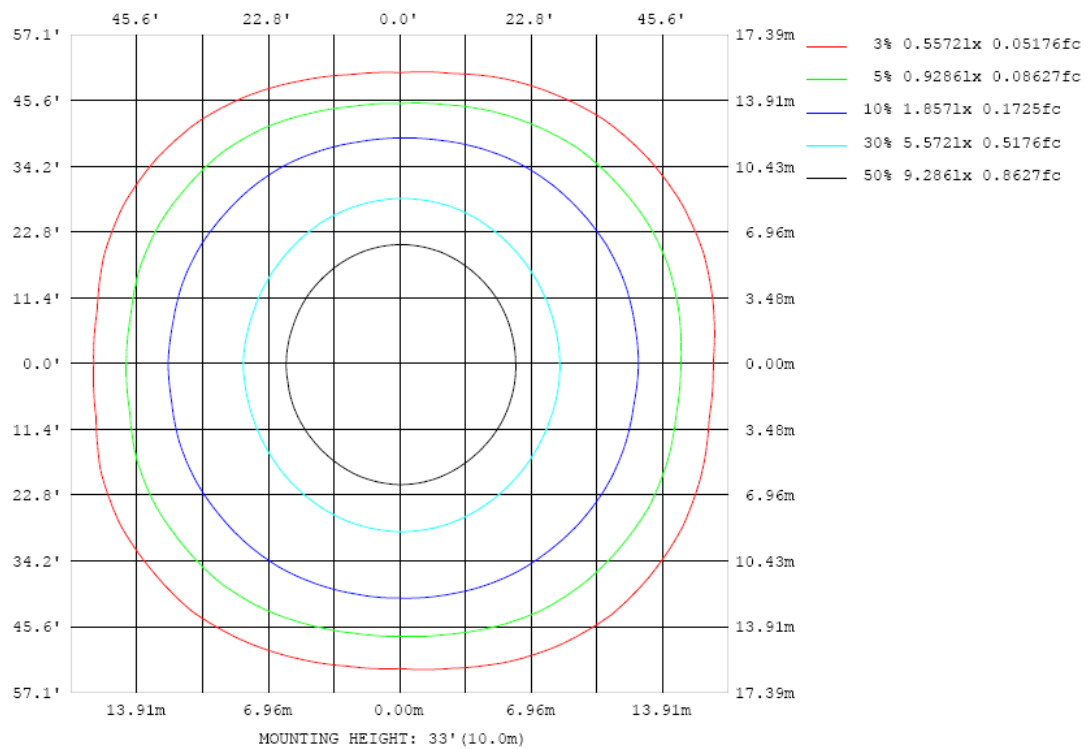


Chart 5: Illuminance Plot (Footcandles)

### Luminous Intensity Distribution Plots- Goniophotometer Method

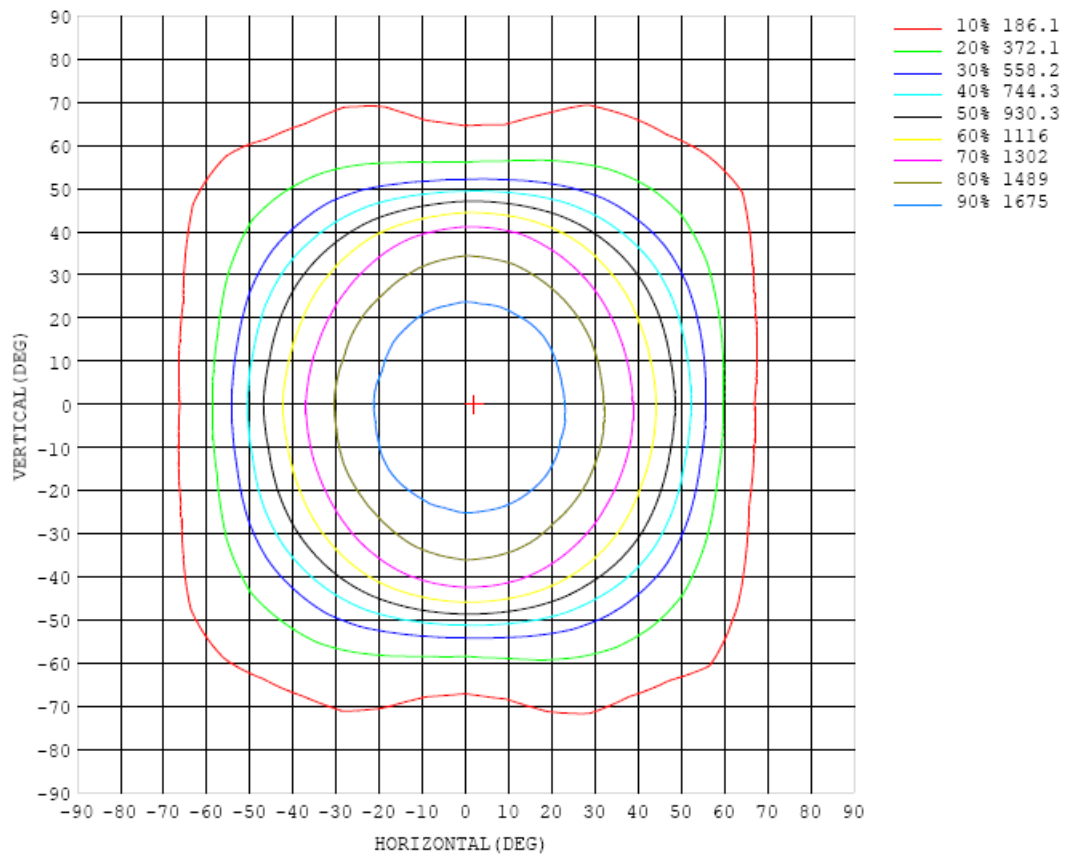


Chart 6: Isocandela Plot

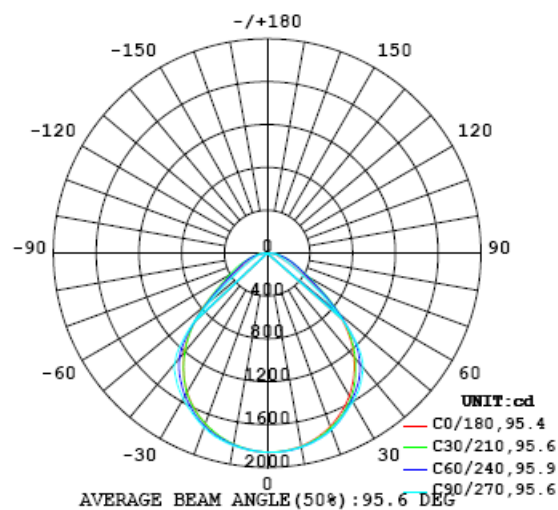


Chart 7: Polar Candela Distribution

## 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	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
5	1856	1856	1846	1853	1858	1852	1857	1858	1854	1858	1847	1852	1847	1850	1852	1849	1843	1842	1847
10	1827	1835	1829	1834	1835	1835	1839	1839	1835	1838	1832	1836	1830	1828	1824	1822	1812	1810	1816
15	1787	1791	1788	1796	1798	1799	1803	1806	1805	1802	1799	1795	1791	1786	1781	1775	1769	1765	1764
20	1723	1728	1723	1733	1746	1746	1755	1755	1749	1754	1740	1745	1735	1733	1726	1716	1700	1693	1696
25	1637	1649	1653	1664	1671	1674	1677	1679	1678	1679	1672	1663	1657	1649	1643	1632	1621	1609	1607
30	1537	1546	1551	1565	1568	1572	1582	1591	1596	1598	1588	1583	1559	1547	1535	1528	1512	1497	1501
35	1411	1421	1426	1433	1446	1459	1484	1503	1508	1513	1498	1484	1460	1433	1407	1386	1377	1365	1363
40	1262	1273	1271	1282	1303	1324	1349	1371	1389	1394	1378	1355	1319	1285	1253	1226	1207	1200	1208
45	1085	1081	1084	1103	1120	1133	1157	1166	1172	1174	1156	1140	1118	1087	1058	1035	1015	998	1013
50	861	848	865	879	881	875	876	864	844	832	829	833	840	829	818	814	799	767	774
55	593	590	621	639	628	622	610	572	532	514	522	547	580	593	586	586	569	528	521
60	362	370	414	443	450	452	428	394	350	325	337	370	400	425	423	423	398	344	329
65	222	235	287	323	326	323	319	290	240	218	229	265	299	303	301	313	289	234	208
70	144	157	208	242	227	228	240	213	170	153	167	199	228	224	215	231	216	162	141
75	106	115	157	178	156	156	172	158	129	119	124	155	169	154	154	163	164	129	115
80	82.9	92.6	122	119	103	99.8	116	115	99.6	93.7	96.4	112	115	102	94.4	110	117	105	84.5
85	52.2	60.2	70.4	67.9	58.1	56.3	61.9	62.8	56.9	54.0	56.0	60.8	58.9	52.9	46.7	57.1	61.3	55.1	47.2
90	3.51	2.82	4.66	4.36	3.24	0.43	4.71	3.73	3.04	2.32	2.22	2.37	2.30	2.30	3.96	2.02	4.12	2.37	0.42
95	0.48	0.53	0.84	0.69	0.48	0.41	0.36	0.28	0.22	0.21	0.21	0.21	0.25	0.29	0.44	0.48	0.75	0.75	0.55
100	0.44	0.46	0.55	1.60	1.88	1.84	2.15	1.82	1.54	1.62	1.54	1.06	1.03	0.87	0.70	0.81	0.70	0.77	0.88
105	0.72	0.82	0.73	0.82	0.90	1.55	2.05	1.85	1.73	1.67	1.54	0.95	0.70	0.68	0.81	0.75	0.90	0.92	1.10
110	0.95	1.36	0.92	1.06	0.92	0.94	0.89	0.75	0.75	0.78	0.68	0.62	0.68	0.74	0.83	0.85	1.06	1.16	1.19
115	1.20	1.73	1.17	1.18	1.20	0.93	0.95	0.87	0.80	0.79	0.75	0.77	0.75	0.77	0.97	0.90	1.26	1.18	1.35
120	1.70	1.95	1.26	1.39	1.52	1.24	1.04	0.90	0.86	0.85	0.84	0.85	0.88	1.00	1.16	1.00	1.43	1.91	1.41
125	1.99	2.08	1.82	1.79	1.90	1.52	1.28	1.12	1.07	1.05	1.05	1.06	1.07	1.26	1.38	1.19	1.32	2.21	1.68
130	1.15	1.42	2.63	1.25	2.26	1.94	1.72	1.34	1.25	1.22	1.22	1.27	1.32	1.46	1.73	1.50	1.33	1.82	1.61
135	1.86	2.75	3.06	1.15	2.55	2.50	1.98	1.66	1.50	1.38	1.40	1.44	1.65	1.78	2.06	1.22	1.48	1.97	1.67
140	1.88	2.83	3.09	3.44	1.24	2.68	2.48	1.97	1.94	1.67	1.83	1.70	1.74	1.94	1.29	1.51	2.23	1.94	1.25
145	1.63	2.47	2.93	3.32	3.25	1.31	2.10	2.35	1.96	1.82	1.75	2.08	2.01	1.19	1.42	2.25	2.38	2.23	1.32
150	1.59	2.47	2.88	3.26	3.84	2.45	1.30	1.20	1.66	1.79	1.75	1.20	1.33	1.38	2.21	2.64	2.29	2.14	1.43
155	1.60	2.13	3.01	3.31	2.62	2.38	3.87	3.34	2.13	1.48	1.53	1.75	1.83	1.91	1.98	2.20	2.19	2.06	1.50
160	1.36	1.49	1.93	2.31	2.64	3.45	3.73	3.49	3.26	2.88	2.54	2.27	2.10	2.04	2.12	2.03	1.79	1.82	1.37
165	1.46	1.51	2.15	2.48	2.86	2.92	3.03	2.94	2.81	2.52	2.32	2.23	2.15	2.12	2.02	1.70	1.72	1.64	1.43
170	1.55	1.58	1.71	2.17	2.29	2.32	2.36	2.34	2.22	2.21	2.05	2.10	1.87	1.77	1.75	1.80	1.78	1.66	1.52
175	1.70	1.74	1.76	1.83	1.88	1.91	1.87	1.94	1.98	1.99	1.82	1.69	1.80	1.97	1.96	1.88	1.80	1.75	1.68
180	1.68	1.70	1.72	1.73	1.74	1.73	1.66	1.63	1.36	1.33	1.68	1.70	1.69	1.65	1.59	1.54	1.59	1.67	1.67

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		1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856		
5		1849	1837	1843	1843	1841	1846	1845	1844	1849	1841	1849	1844	1849	1850	1852	1846	1845		
10		1815	1804	1807	1815	1810	1815	1821	1820	1824	1819	1822	1822	1824	1826	1824	1825	1829		
15		1761	1758	1761	1763	1767	1774	1779	1781	1783	1786	1791	1785	1785	1785	1786	1779	1775		
20		1696	1684	1696	1704	1709	1718	1724	1723	1731	1723	1731	1730	1732	1730	1724	1720	1723		
25		1604	1600	1609	1623	1626	1635	1641	1645	1654	1652	1655	1653	1652	1652	1648	1640	1633		
30		1496	1490	1505	1512	1521	1536	1549	1558	1568	1569	1570	1559	1554	1550	1547	1538	1539		
35		1359	1353	1366	1378	1397	1422	1446	1458	1474	1471	1466	1452	1438	1425	1416	1412	1409		
40		1190	1184	1197	1216	1241	1278	1308	1333	1348	1348	1338	1316	1294	1276	1263	1255	1257		
45		991	997	1005	1009	1021	1038	1040	1049	1074	1085	1093	1098	1092	1081	1076	1069	1071		
50		760	770	769	755	752	743	719	697	698	715	755	796	816	834	851	860	851		
55		519	545	549	538	533	503	459	421	409	432	478	522	563	584	612	621	608		
60		339	383	404	397	380	350	315	279	264	280	326	362	397	419	429	423	396		
65		227	278	307	274	265	266	236	198	179	187	232	280	291	299	316	308	263		
70		159	206	220	194	190	204	187	150	129	136	170	209	214	207	223	229	174		
75		122	160	152	140	127	146	141	113	102	105	127	153	145	142	157	171	127		
80		94.3	112	98.0	82.7	77.2	89.6	92.0	83.1	75.6	77.5	89.2	99.8	91.6	82.9	108	123	101		
85		51.0	56.7	47.5	37.3	34.3	38.1	40.6	38.8	36.1	38.4	45.2	48.1	47.3	46.7	61.2	64.1	62.7		
90		1.26	5.41	0.45	0.56	0.49	0.33	0.24	0.19	0.18	0.19	0.20	0.23	0.27	0.55	0.84	0.97	0.64		
95		0.92	1.10	0.90	1.15	0.88	0.66	0.53	0.47	0.44	0.41	0.42	0.47	0.53	0.61	0.67	0.73	0.71		
100		1.36	1.61	0.86	1.34	1.38	1.25	1.36	1.45	1.68	1.78	1.73	1.87	1.99	2.00	1.60	0.60	0.52		
105		1.59	2.13	1.00	1.13	1.24	1.16	1.46	2.02	2.26	2.36	2.29	1.99	1.48	1.08	0.99	0.76	0.83		
110		1.69	1.34	0.97	1.29	1.11	1.05	0.91	0.95	0.98	1.01	0.96	1.07	1.15	1.19	1.27	0.84	1.25		
115		1.53	1.49	1.08	1.32	1.22	1.12	1.04	1.04	1.05	1.06	1.07	1.16	1.24	1.44	1.44	1.08	1.79		
120		1.66	1.50	1.27	1.45	1.37	1.26	1.18	1.19	1.21	1.22	1.26	1.28	1.51	1.76	1.62	1.22	1.90		
125		1.87	1.69	1.46	1.68	1.68	1.52	1.42	1.34	1.37	1.37	1.42	1.75	1.77	2.04	2.04	1.07	1.99		
130		1.77	1.81	1.41	2.07	1.95	1.80	1.79	1.72	1.61	1.65	1.76	1.98	2.49	2.63	2.65	2.28	1.60		
135		2.11	1.75	1.23	1.98	2.27	2.23	1.90	1.89	2.05	2.04	2.28	2.53	3.18	2.98	1.26	2.89	2.83		
140		1.91	2.17	2.03	1.41	2.42	2.48	2.48	2.37	2.63	2.55	2.87	3.29	3.44	1.51	2.83	3.04	2.83		
145		2.03	2.25	2.29	2.15	1.58	2.21	2.62	2.87	2.93	3.10	3.33	3.50	1.58	2.21	2.89	2.72	2.58		
150		2.02	2.21	2.34	2.43	2.13	1.49	1.76	1.80	2.26	1.99	1.63	1.41	1.81	3.45	3.15	2.82	2.59		
155		1.97	2.13	2.28	2.15	2.22	2.44	2.46	2.26	2.07	2.38	3.74	4.00	2.84	2.24	2.71	2.83	2.61		
160		1.67	1.82	1.77	2.07	2.50	2.48	2.46	2.73	2.87	3.18	3.54	3.60	3.44	3.14	2.32	2.05	1.94		
165		1.45	1.61	1.72	1.69	2.12	2.26	2.39	2.40	2.51	2.79	2.98	2.94	2.95	2.73	2.49	2.21	1.98		
170		1.52	1.64	1.75	1.73	1.67	1.74	1.88	2.11	2.18	2.23	2.19	2.25	2.19	2.11	2.12	2.10	1.85		
175		1.68	1.76	1.89	1.99	2.02	1.98	1.80	1.69	1.67	1.84	1.87	1.88	1.81	1.86	1.92	1.83	1.73		
180		1.67	1.69	1.71	1.72	1.71	1.73	1.71	1.70	1.59	1.57	1.56	1.67	1.68	1.70	1.68	1.67	1.67		

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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