



## LM-79-19 TEST REPORT

for

**Industrial Lighting Products, LLC**

3224 McCraney Loop, Sanford, FL, 32771

**LED Retrofit-kits in Lithonia 2GT8 lensed 2x2**

**Model: ULB2-20L-U-35-L3**

**ULB2-20L-U-35-L3-MWS**

**20LB/2F/835/U/A3**

**20LB/2F/835/U/A3/MWS**

**Laboratory: Leading Testing Laboratories**

**NVLAP CODE: 200960-0**

3rd Floor, Bld. 2, NO. 96 Longchuanwu Rd Qianjiang Economy Dev. Zone, YuhangDist,  
Hangzhou, Zhejiang Province, China 311100

Tel: +86571 86376106

www.ltlqa.com

Report No.: HZ25030014b

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: **ULB2-20L-U-35-L3**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
124.9	4023.7	32.22	0.9955
CCT (K)	CRI	Stabilization Time (Light & Power)	
3543	82.3	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. 18, 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

## TABLE OF CONTENT

LM-79-19 TEST REPORT.....	1
TEST SUMMARY .....	2
SAMPLE PHOTO .....	4
TEST RESULTS .....	5
Sphere-Spectroradiometer Method.....	5
Goniophotometer Method .....	6
Spectral Power Distribution - Sphere Spectroradiometer Method .....	7
Chromaticity Diagram - Sphere Spectroradiometer Method.....	8
Nominal CCT Quadrangles – Sphere Spectroradiometer Method .....	9
Color Rendition Report – Sphere Spectroradiometer Method .....	10
Zonal Lumen Tabulation- Goniophotometer Method .....	11
Illuminance Plots- Goniophotometer Method .....	12
Luminous Intensity Distribution Plots- Goniophotometer Method.....	13
Luminous Intensity Data- Goniophotometer Method .....	14
EQUIPMENT LIST .....	16
TEST METHODS .....	16
Seasoning of SSL Product.....	16
Sphere-Spectroradiometer Method- Photometric and Electrical Measurements.....	16
Goniophotometer Method .....	17
Photometric and Electrical Measurements .....	17
Color Characteristics Measurements.....	17

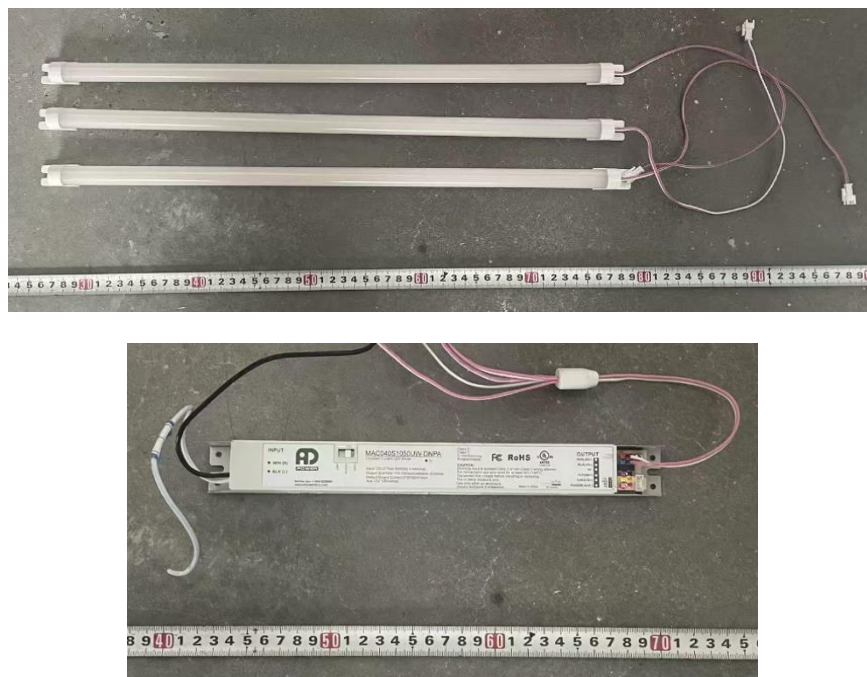
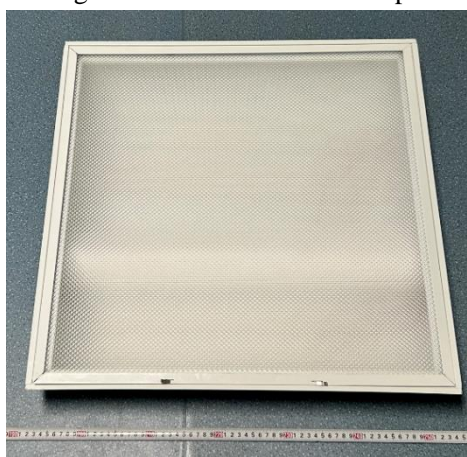


Figure 1- Overview of the sample



Sample in Lithonia 2GT8 lensed 2x2

#### Equipment Under Test(EUT)

<b>Name</b>	: LED Retrofit-kits
<b>Model</b>	: ULB2-20L-U-35-L3      ULB2-20L-U-35-L3-MWS 20LB/2F/835/U/A3      20LB/2F/835/U/A3/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	0.9955	0.9539
Test Power (W)	32.22	32.28
THD A%	6.41	13.03
Luminous Efficacy (lm/W)	124.9	124.9
Total Luminous Flux (lm)	4023.7	4030.4
Color Rendering Index (CRI)	82.3	
R9	8.5	
Correlated Color Temperature (CCT)(K)	3543	
Chromaticity Chroma x	0.4027	
Chromaticity Chroma y	0.3892	
Chromaticity Chroma u	0.2346	
Chromaticity Chroma v	0.3402	
Duv	-0.0001	
Chromaticity Chroma u'	0.2346	
Chromaticity Chroma v'	0.5103	

Special Color Rendering Indices	
R1	80.7
R2	88.3
R3	94.5
R4	81.7
R5	80.7
R6	84.3
R7	85.3
R8	63.2
R9	8.5
R10	72.7
R11	80.9
R12	62.8
R13	82.3
R14	96.9

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	0.9953
Power (W)	32.23
Luminous Efficacy (lm/W)	125.1
Total Luminous Flux (lm)	4030.9
Beam Angle ( ° )	97.4 (0°-180°) / 87.8 (90°-270°)
Center Beam Candle Power (cd)	1785
Maximum Beam Candle Power (cd)	1787 (At: C=10.0, Gamma=0.5)
Spacing Criteria	1.26 (0°-180°) / 1.13 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	85.32%
Zonal Lumens in the 60 °-90 °Zone	14.22%
Zonal Lumens in the 90 °-120 °Zone	0.16%
Zonal Lumens in the 120 °-180 °Zone	0.30%

Table 3: Test data per Goniophotometer Method

### Spectral Power Distribution - Sphere Spectroradiometer Method

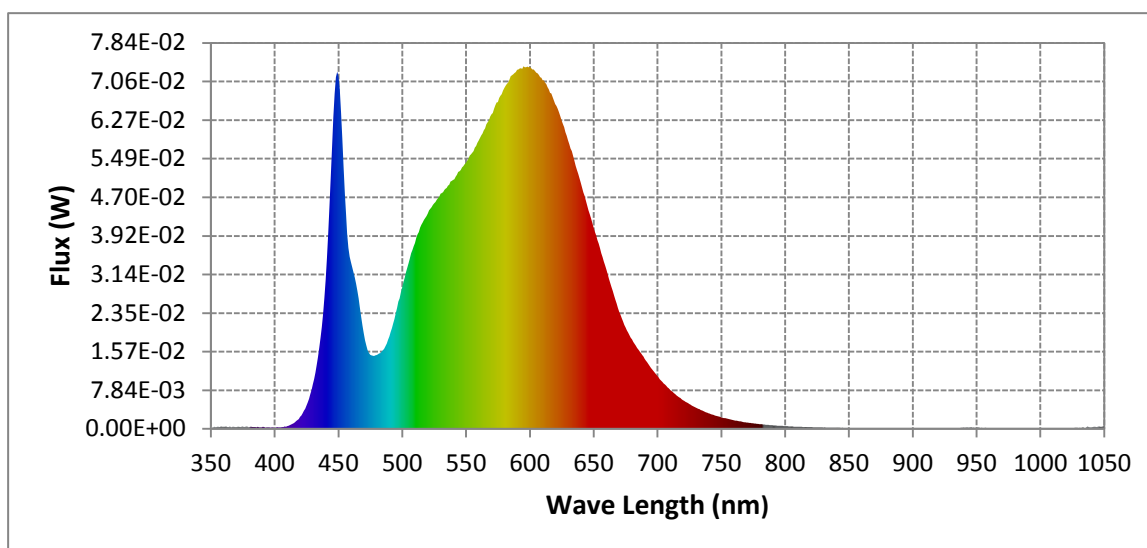


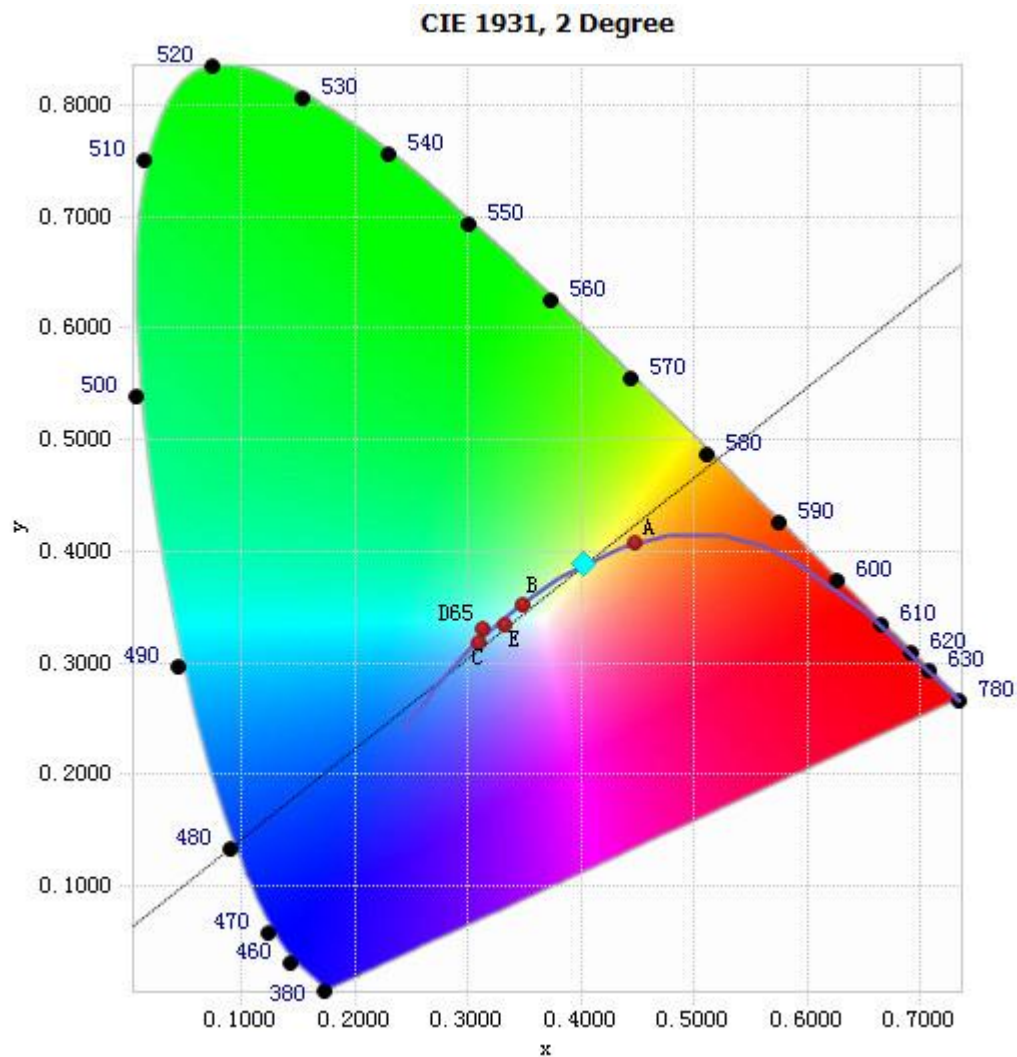
Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	3.22E-04	485	1.60E-02	590	7.29E-02	695	1.24E-02
385	3.50E-04	490	1.88E-02	595	7.36E-02	700	1.07E-02
390	3.07E-04	495	2.35E-02	600	7.35E-02	705	9.20E-03
395	3.20E-04	500	2.87E-02	605	7.23E-02	710	7.93E-03
400	1.93E-04	505	3.37E-02	610	7.08E-02	715	6.81E-03
405	2.92E-04	510	3.77E-02	615	6.89E-02	720	5.84E-03
410	5.46E-04	515	4.14E-02	620	6.60E-02	725	5.05E-03
415	1.16E-03	520	4.37E-02	625	6.26E-02	730	4.32E-03
420	2.41E-03	525	4.58E-02	630	5.86E-02	735	3.73E-03
425	4.70E-03	530	4.77E-02	635	5.44E-02	740	3.17E-03
430	9.04E-03	535	4.89E-02	640	4.99E-02	745	2.73E-03
435	1.65E-02	540	5.05E-02	645	4.53E-02	750	2.34E-03
440	3.03E-02	545	5.23E-02	650	4.09E-02	755	2.02E-03
445	5.72E-02	550	5.40E-02	655	3.67E-02	760	1.73E-03
450	7.17E-02	555	5.61E-02	660	3.23E-02	765	1.50E-03
455	4.77E-02	560	5.85E-02	665	2.80E-02	770	1.29E-03
460	3.38E-02	565	6.10E-02	670	2.38E-02	775	1.13E-03
465	2.81E-02	570	6.39E-02	675	2.06E-02	780	9.63E-04
470	1.94E-02	575	6.64E-02	680	1.81E-02		
475	1.50E-02	580	6.92E-02	685	1.61E-02		
480	1.50E-02	585	7.16E-02	690	1.43E-02		

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



## Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4027, 0.3892)

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

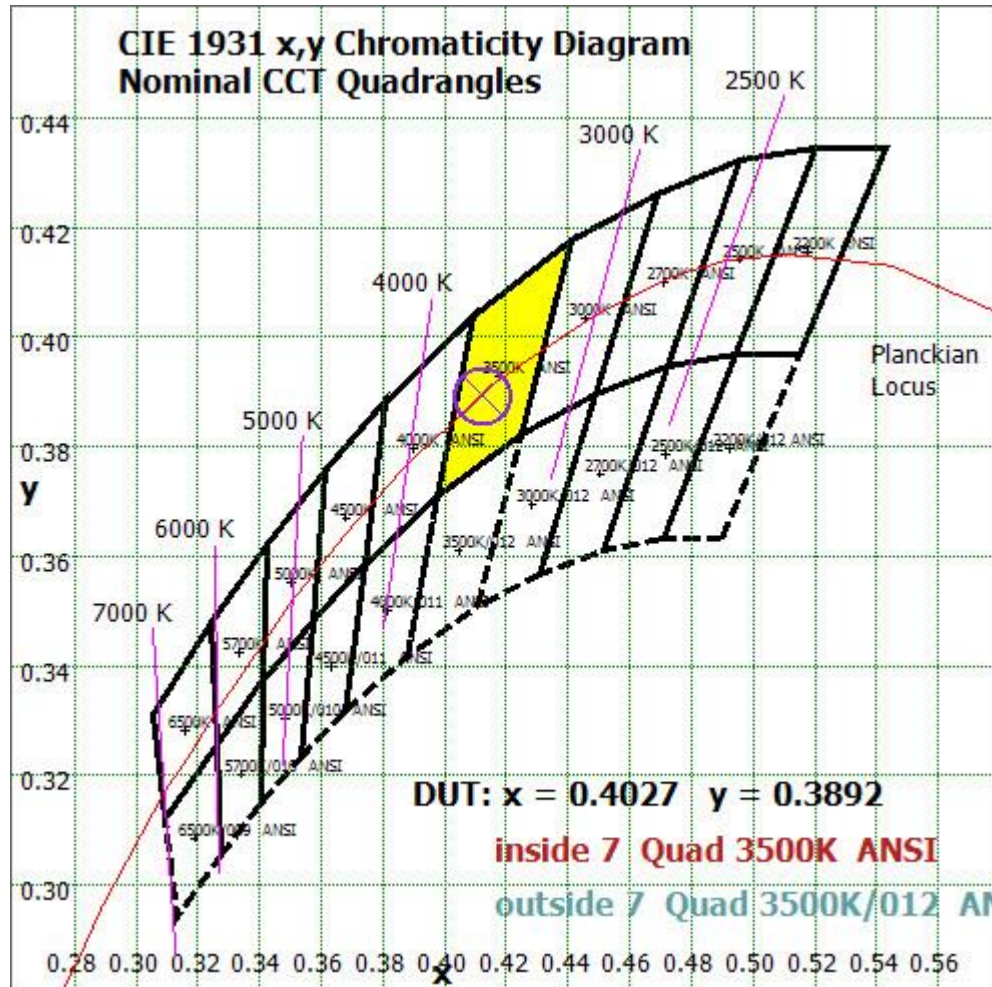


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram



Quality Assured  
Color Rendition Report – Sphere Spectroradiometer Method

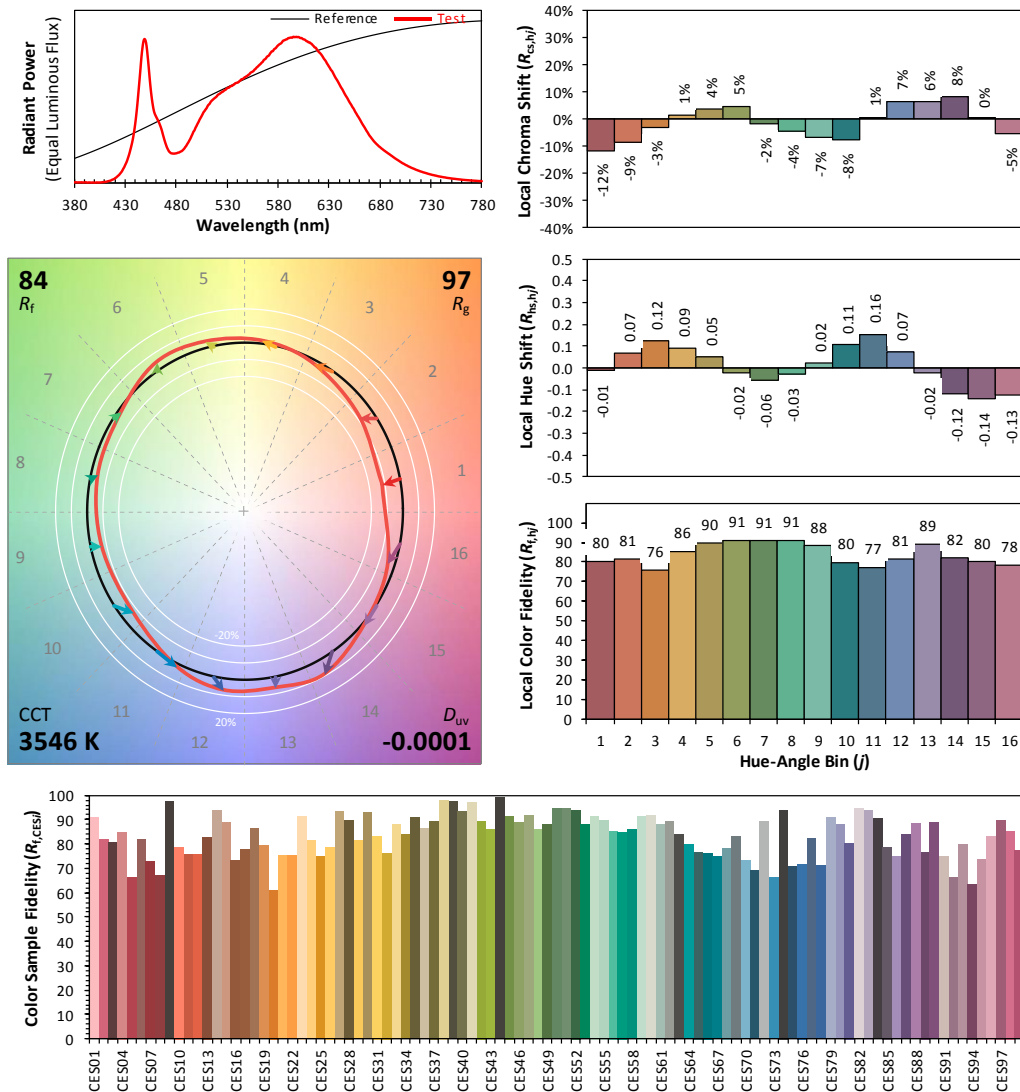
## ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: Industrial Lighting Products, LLC

Date: 2025/03/18

Model: ULB2-20L-U-35-L3



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

$x$  0.4027  
 $y$  0.3892  
 $u'$  0.2346  
 $v'$  0.5103

CIE 13.3-1995  
(CRI)

$R_a$  82  
 $R_g$  9

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	168.692	4.18%
10- 20	480.316	11.92%
20- 30	711.302	17.65%
30- 40	807.711	20.04%
40- 50	736.212	18.26%
50- 60	534.824	13.27%
60- 70	321.664	7.98%
70- 80	189.83	4.71%
80- 90	61.807	1.53%
90-100	1.14	0.03%
100-110	2.44	0.06%
110-120	2.955	0.07%
120-130	3.047	0.08%
130-140	2.905	0.07%
140-150	2.597	0.06%
150-160	1.972	0.05%
160-170	1.137	0.03%
170-180	0.349	0.01%
Total	4030.9	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	3439.057	85.32%
60- 90	573.301	14.22%
0-90	4012.358	99.54%
90- 180	18.542	0.46%
0- 180	4030.9	100%

Table 5: Zonal Lumen

### Illuminance Plots- Goniophotometer Method

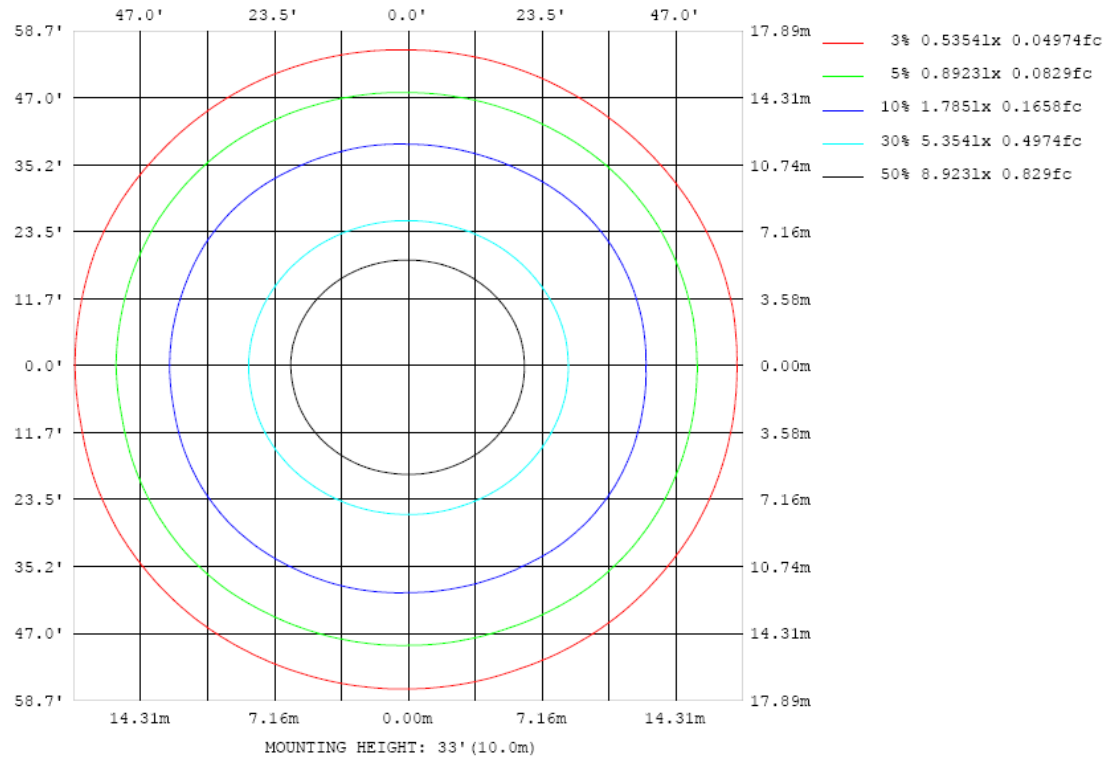


Chart 5: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

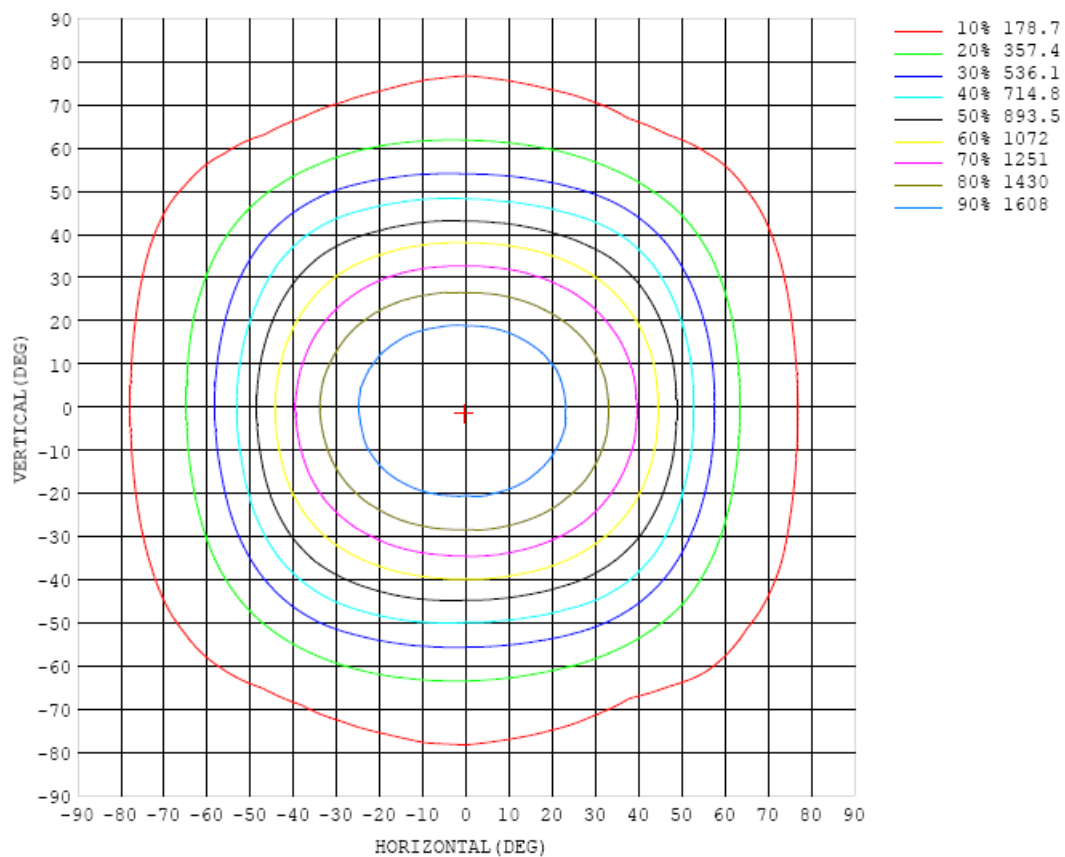


Chart 6: Isocandela Plot

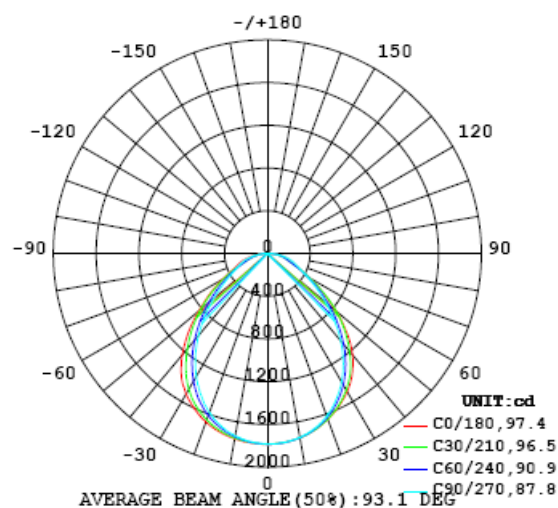


Chart 7: Polar Candela Distribution

## 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	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785
5	1774	1780	1777	1775	1773	1775	1778	1777	1783	1772	1777	1782	1782	1778	1780	1782	1783	1777	1780
10	1752	1755	1750	1752	1750	1752	1750	1750	1750	1751	1748	1751	1755	1756	1760	1761	1764	1763	1758
15	1710	1713	1711	1708	1706	1704	1704	1701	1703	1694	1703	1707	1711	1715	1722	1726	1727	1728	1730
20	1650	1658	1653	1650	1644	1640	1634	1627	1628	1623	1622	1632	1641	1651	1661	1671	1679	1676	1679
25	1579	1582	1579	1571	1562	1549	1539	1528	1523	1513	1523	1534	1549	1564	1582	1594	1603	1605	1605
30	1493	1495	1487	1475	1454	1438	1420	1403	1396	1389	1392	1408	1426	1447	1470	1491	1507	1512	1521
35	1380	1384	1369	1352	1327	1299	1275	1256	1243	1233	1240	1257	1280	1303	1332	1360	1384	1392	1401
40	1239	1239	1220	1195	1165	1139	1109	1086	1075	1068	1076	1092	1114	1141	1174	1201	1220	1231	1237
45	1051	1056	1045	1024	997	964	932	904	890	884	899	921	945	975	1007	1030	1044	1042	1045
50	839	850	849	841	820	791	754	727	715	711	728	747	770	804	833	847	847	833	834
55	626	633	636	639	628	610	583	563	556	554	563	578	596	625	646	655	654	648	654
60	454	458	458	457	449	442	433	423	423	426	430	437	450	464	475	483	482	473	479
65	326	325	321	318	306	303	310	319	328	334	336	335	332	328	330	338	347	352	355
70	258	253	236	222	210	205	221	245	263	272	272	264	243	224	219	230	249	272	283
75	202	195	175	172	166	162	171	188	207	220	217	199	179	167	165	172	181	200	223
80	135	136	123	121	126	121	126	132	142	153	149	129	121	115	111	119	120	134	143
85	61.3	68.3	66.0	59.4	61.4	57.5	65.5	68.5	74.8	70.1	73.1	65.5	60.5	51.6	50.2	52.7	53.2	57.9	56.3
90	3.84	2.81	3.58	4.10	5.55	4.11	4.62	4.78	2.58	4.74	4.76	6.44	4.61	3.66	3.09	1.84	2.05	0.23	0.16
95	0.23	0.27	0.40	0.56	0.85	0.93	1.08	1.26	1.36	1.07	1.38	1.32	1.20	0.90	0.88	0.68	0.52	0.30	0.33
100	0.66	0.88	0.92	1.22	1.53	1.67	1.79	2.00	1.98	1.37	1.57	1.94	1.80	1.73	1.53	1.29	1.02	0.80	0.77
105	2.11	2.27	2.01	2.70	3.17	3.11	2.83	2.72	2.60	2.01	2.14	2.66	2.96	2.78	2.44	1.94	1.60	1.56	1.65
110	2.47	2.68	2.67	2.22	2.51	3.08	3.25	3.13	3.00	2.70	2.73	3.30	3.41	3.34	3.30	2.83	2.27	2.42	2.11
115	0.97	1.66	1.84	2.31	3.15	3.45	3.55	3.56	3.24	3.26	3.15	3.78	3.72	3.79	3.53	3.07	2.71	3.14	2.82
120	2.34	2.21	2.60	2.95	3.02	3.37	3.53	3.60	3.52	3.77	3.48	4.05	3.97	3.98	3.78	3.69	3.09	2.88	2.18
125	2.73	2.49	3.16	2.96	3.30	3.38	3.75	3.73	4.10	4.16	3.96	4.22	4.14	3.82	4.01	3.66	3.95	3.57	3.50
130	3.43	2.38	3.47	3.35	3.70	3.80	4.03	3.88	3.94	4.18	3.90	3.85	4.19	4.25	3.99	3.62	3.96	3.26	3.37
135	3.22	2.51	3.84	3.79	3.61	4.25	4.19	4.24	4.41	4.39	4.33	4.15	4.37	4.39	3.85	4.21	4.24	3.30	3.94
140	3.63	3.24	4.03	4.19	4.16	3.78	4.21	4.57	4.40	4.43	4.37	4.24	4.12	4.38	4.48	4.47	4.54	2.63	4.00
145	4.03	3.91	3.50	4.05	4.10	4.31	4.42	4.49	4.24	4.43	4.25	3.98	4.09	4.41	4.95	4.71	4.77	2.85	4.64
150	3.51	3.46	2.55	4.26	4.50	4.76	4.80	4.52	4.53	4.48	4.58	4.39	4.47	4.43	4.22	4.95	4.40	3.32	4.91
155	4.75	5.02	3.29	4.02	5.04	5.17	4.73	4.66	4.70	4.52	4.43	4.34	4.11	4.27	4.54	4.43	2.94	3.91	4.92
160	5.28	5.51	3.78	3.05	4.23	4.79	4.80	4.71	4.61	4.41	4.14	4.38	4.51	4.60	4.43	3.59	3.31	4.08	4.05
165	4.53	4.72	4.38	3.42	2.89	3.45	3.78	4.22	4.30	4.31	4.23	4.21	4.04	3.82	3.34	3.42	3.68	4.40	4.35
170	4.18	4.37	4.40	4.14	3.53	3.23	2.92	2.95	3.20	3.14	3.10	3.03	3.06	3.38	3.58	3.87	4.27	4.25	4.15
175	3.47	3.70	3.83	3.67	3.53	3.52	3.56	3.53	3.29	3.31	3.39	3.55	3.64	3.84	4.08	4.06	4.02	4.00	3.84
180	3.78	3.99	3.70	3.99	3.62	3.95	4.05	3.88	4.00	4.44	4.32	4.04	3.65	3.67	3.99	3.63	3.44	3.43	3.61

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	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785		
5	1785	1774	1774	1771	1774	1774	1771	1774	1765	1768	1771	1773	1772	1774	1774	1778	1777		
10	1761	1758	1753	1749	1745	1742	1738	1740	1735	1737	1738	1739	1740	1743	1748	1753	1748		
15	1731	1718	1714	1703	1698	1689	1681	1678	1670	1674	1677	1683	1687	1696	1701	1706	1711		
20	1675	1669	1658	1645	1628	1614	1600	1594	1585	1586	1596	1603	1612	1626	1638	1648	1650		
25	1607	1592	1575	1553	1535	1512	1490	1478	1466	1474	1483	1496	1513	1533	1553	1569	1574		
30	1517	1493	1468	1440	1409	1380	1356	1342	1330	1334	1350	1369	1391	1421	1450	1473	1487		
35	1392	1363	1330	1291	1260	1229	1200	1183	1172	1178	1196	1220	1248	1284	1319	1356	1375		
40	1221	1194	1162	1130	1094	1058	1032	1014	1001	1008	1024	1050	1087	1124	1162	1201	1230		
45	1035	1015	993	963	927	886	857	840	824	824	840	868	906	952	989	1025	1049		
50	828	820	811	791	757	716	688	670	655	655	666	690	730	774	807	828	842		
55	648	637	633	613	588	557	533	519	507	509	517	533	560	589	611	620	627		
60	476	478	465	447	431	418	406	396	389	388	390	394	401	416	435	450	458		
65	358	344	321	303	296	301	308	311	311	305	296	287	278	281	298	315	328		
70	278	245	217	200	201	217	238	253	256	247	231	214	196	196	208	227	251		
75	204	175	159	154	155	156	169	191	202	189	173	163	157	159	163	171	188		
80	135	116	108	97.1	95.3	101	104	124	127	124	115	115	110	116	117	118	133		
85	57.3	48.7	41.5	39.1	36.5	40.3	42.1	47.7	45.1	50.6	50.4	50.9	47.0	51.1	53.3	61.1	69.7		
90	0.14	0.33	0.54	0.84	1.41	1.25	1.03	1.64	0.90	1.57	1.32	3.37	2.92	2.11	1.39	0.49	0.74		
95	0.32	0.49	0.65	0.86	1.01	1.05	1.09	1.27	0.90	1.30	1.16	1.01	0.87	0.84	0.66	0.46	0.28		
100	0.90	1.17	1.18	1.35	1.71	1.89	2.06	1.89	1.36	1.73	1.95	2.01	2.07	1.85	1.56	1.03	0.79		
105	1.68	1.72	2.13	2.51	2.73	2.89	2.58	2.33	1.87	2.25	2.66	2.84	2.48	3.01	2.71	1.97	2.47		
110	2.43	2.58	2.75	3.27	3.24	3.30	3.06	2.65	2.43	2.67	3.07	3.29	3.18	2.45	2.03	2.14	2.83		
115	3.07	3.04	2.81	3.03	3.58	3.44	3.30	2.92	2.93	2.91	3.34	3.41	3.39	3.15	2.52	1.83	1.52		
120	2.19	3.07	2.82	3.17	3.40	3.45	3.42	3.16	3.31	3.17	3.63	3.61	3.37	3.22	2.91	2.81	2.39		
125	3.46	3.71	3.36	3.09	3.25	3.23	3.31	3.16	3.44	3.20	3.47	3.49	3.35	3.38	3.22	3.04	2.61		
130	2.73	3.76	3.78	3.44	3.25	3.51	3.22	3.11	3.29	3.10	3.35	3.54	3.50	3.12	3.07	3.55	2.90		
135	3.62	3.71	3.99	3.67	4.00	3.25	3.27	3.61	3.64	3.70	3.59	3.41	3.62	3.44	3.65	3.48	2.78		
140	3.73	4.35	4.30	4.36	3.91	3.71	3.79	3.64	3.71	3.60	3.78	4.29	3.75	3.92	4.19	3.73	3.37		
145	4.41	4.28	3.75	4.62	4.25	3.90	3.56	3.78	3.59	4.09	4.07	4.08	4.54	4.18	3.43	3.99	4.17		
150	4.95	4.40	4.95	3.55	3.85	4.19	4.07	4.25	3.76	3.91	4.17	4.36	4.95	4.28	3.86	3.58	3.50		
155	5.07	4.54	3.92	4.25	3.64	3.82	4.17	4.45	3.87	4.41	4.00	3.81	3.69	3.89	4.70	4.52	5.07		
160	4.21	4.21	3.96	3.95	4.47	4.34	4.01	3.84	3.74	3.99	3.90	3.89	3.84	3.50	3.71	4.96	5.60		
165	4.37	4.45	4.22	4.17	3.79	3.81	3.72	3.94	3.80	3.78	3.87	3.44	3.40	3.38	4.02	4.40	4.21		
170	4.13	4.16	4.26	4.21	4.09	4.05	3.87	3.60	3.32	3.17	3.36	3.32	3.31	3.34	3.37	3.58	3.73		
175	3.87	3.88	3.93	3.93	3.88	3.82	3.68	3.53	3.29	3.31	3.21	3.35	3.41	3.34	3.50	3.60	3.82		
180	3.60	3.73	3.76	3.83	3.91	3.86	3.89	3.75	3.99	4.10	4.04	3.72	3.81	3.75	3.82	3.78	3.74		

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 \*\*\*

This report is considered invalidated without the Special Seal for Inspection of the LTL. This report shall not be altered, increased or deleted. The results shown in this test report refer only to the sample(s) tested. Without written approval of LTL, this test report shall not be copied except in full and published as advertisement.