



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-40-L2

ULB2-20L-U-40-L2-MWS

20LB/2F/840/U/A2

20LB/2F/840/U/A2/MWS

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ25030014d

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: **ULB2-20L-U-40-L2**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
125.4	2755.7	21.97	0.9953
CCT (K)	CRI	Stabilization Time (Light & Power)	
4047	82.7	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. 18, 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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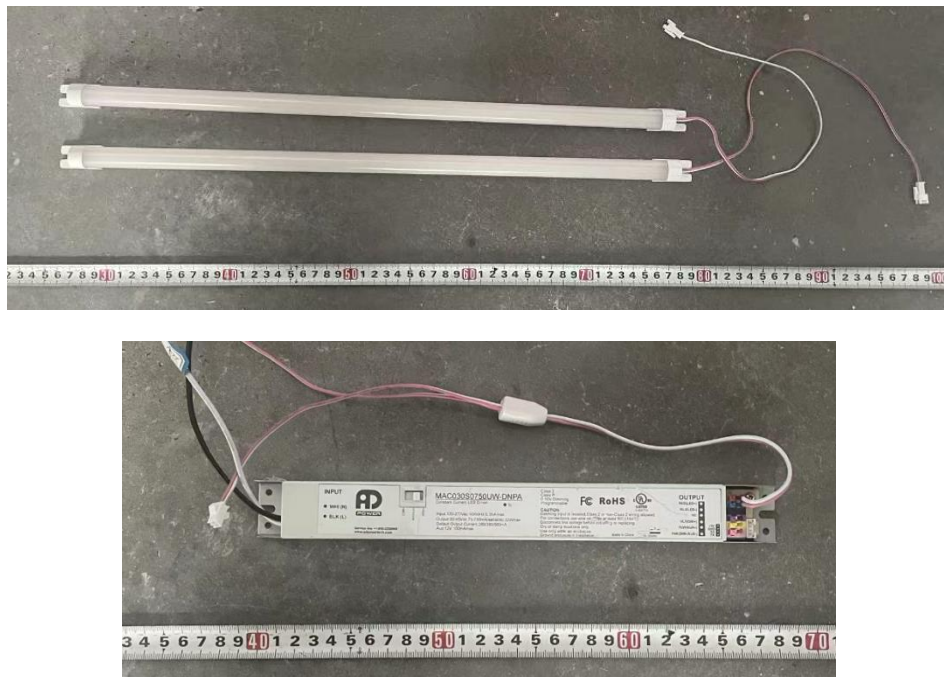
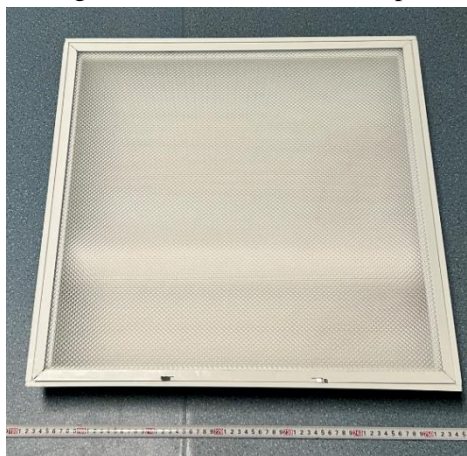


Figure 1- Overview of the sample



Sample in Lithonia 2GT8 lensed 2x2

Equipment Under Test(EUT)

Name	: LED Retrofit-kits	
Model	: ULB2-20L-U-40-L2	ULB2-20L-U-40-L2-MWS
	20LB/2F/840/U/A2	20LB/2F/840/U/A2/MWS
Electrical Ratings	: 120-277V, 50/60Hz	
Product Description	: Field-Adjustable 22W/18W/14W, 4000K LED Tube supplied by a LED driver: MAC030S0750UW-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)	0.184	0.083
Power Factor	0.9953	0.9536
Test Power (W)	21.97	21.86
THD A%	6.03	10.02
Luminous Efficacy (lm/W)	125.4	125.1
Total Luminous Flux (lm)	2755.7	2733.6
Color Rendering Index (CRI)	82.7	
R9	9.2	
Correlated Color Temperature (CCT)(K)	4047	
Chromaticity Chroma x	0.3789	
Chromaticity Chroma y	0.3777	
Chromaticity Chroma u	0.2237	
Chromaticity Chroma v	0.3345	
Duv	0.0009	
Chromaticity Chroma u'	0.2237	
Chromaticity Chroma v'	0.5018	

Special Color Rendering Indices	
R1	81
R2	87.9
R3	93.5
R4	82.5
R5	81.1
R6	83.4
R7	86.6
R8	65.6
R9	9.2
R10	71.6
R11	81.8
R12	60.4
R13	82.6
R14	96.4

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)	0.184
Power Factor	0.9955
Power (W)	21.96
Luminous Efficacy (lm/W)	125.7
Total Luminous Flux (lm)	2760.1
Beam Angle (°)	99.0 (0°-180°) / 87.8 (90°-270°)
Center Beam Candle Power (cd)	1212
Maximum Beam Candle Power (cd)	1214 (At: C=90.0, Gamma=0.5)
Spacing Criteria	1.26 (0°-180°) / 1.13 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	85.09%
Zonal Lumens in the 60 °-90 °Zone	14.45%
Zonal Lumens in the 90 °-120 °Zone	0.17%
Zonal Lumens in the 120 °-180 °Zone	0.30%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

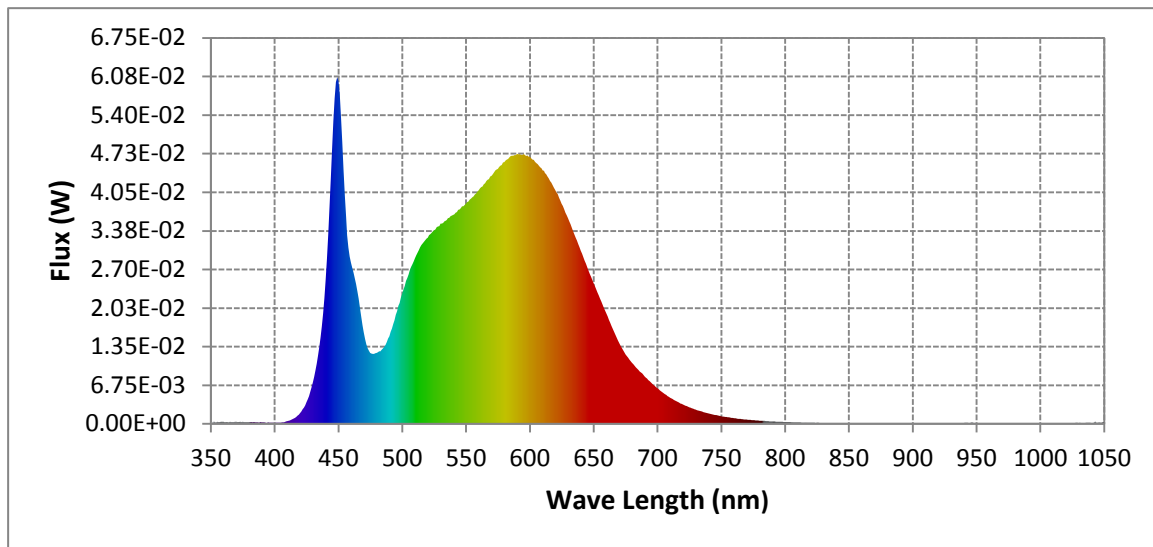


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	3.20E-04	485	1.32E-02	590	4.72E-02	695	7.23E-03
385	2.56E-04	490	1.53E-02	595	4.72E-02	700	6.26E-03
390	2.24E-04	495	1.90E-02	600	4.67E-02	705	5.37E-03
395	2.28E-04	500	2.28E-02	605	4.56E-02	710	4.59E-03
400	1.63E-04	505	2.61E-02	610	4.43E-02	715	3.95E-03
405	2.11E-04	510	2.89E-02	615	4.29E-02	720	3.37E-03
410	4.60E-04	515	3.13E-02	620	4.09E-02	725	2.89E-03
415	8.96E-04	520	3.25E-02	625	3.85E-02	730	2.48E-03
420	1.87E-03	525	3.38E-02	630	3.60E-02	735	2.14E-03
425	3.75E-03	530	3.50E-02	635	3.31E-02	740	1.81E-03
430	7.23E-03	535	3.56E-02	640	3.03E-02	745	1.55E-03
435	1.34E-02	540	3.65E-02	645	2.74E-02	750	1.33E-03
440	2.52E-02	545	3.75E-02	650	2.46E-02	755	1.15E-03
445	4.80E-02	550	3.85E-02	655	2.19E-02	760	9.75E-04
450	6.00E-02	555	3.96E-02	660	1.93E-02	765	8.54E-04
455	3.98E-02	560	4.08E-02	665	1.66E-02	770	7.27E-04
460	2.82E-02	565	4.21E-02	670	1.41E-02	775	6.41E-04
465	2.32E-02	570	4.34E-02	675	1.21E-02	780	5.58E-04
470	1.60E-02	575	4.46E-02	680	1.07E-02		
475	1.24E-02	580	4.58E-02	685	9.45E-03		
480	1.24E-02	585	4.68E-02	690	8.34E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method

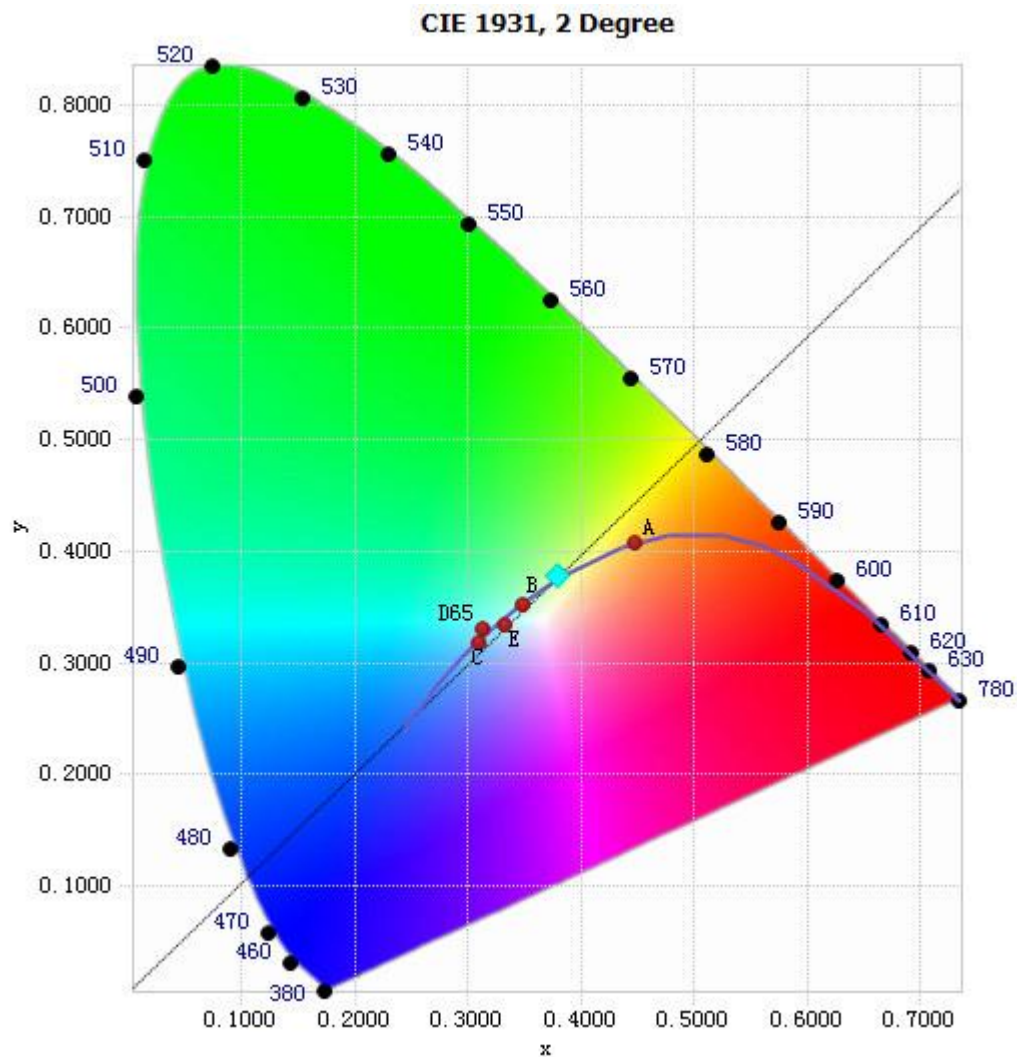


Chart 2: Chromaticity Diagram per Sphere - Spectroradiometer Method

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

Nominal CCT Quadrangles – Sphere Spectroradiometer Method

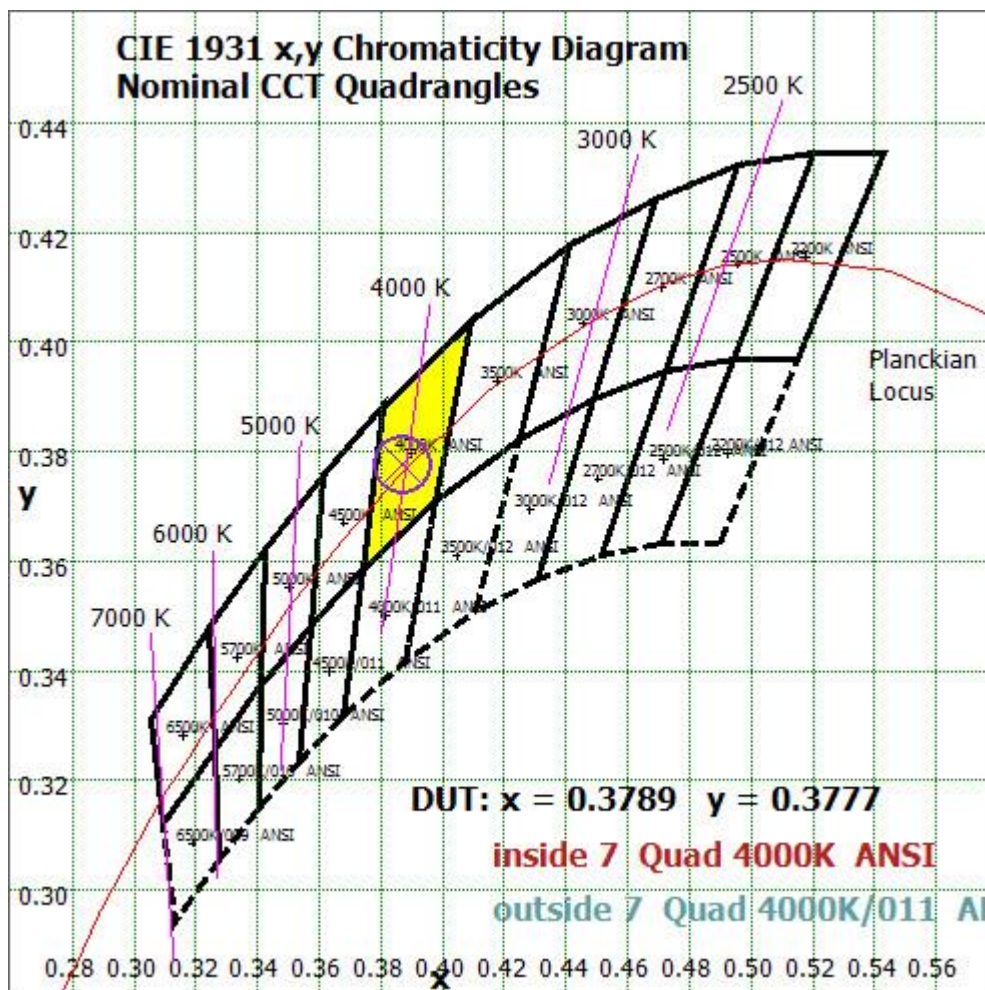


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

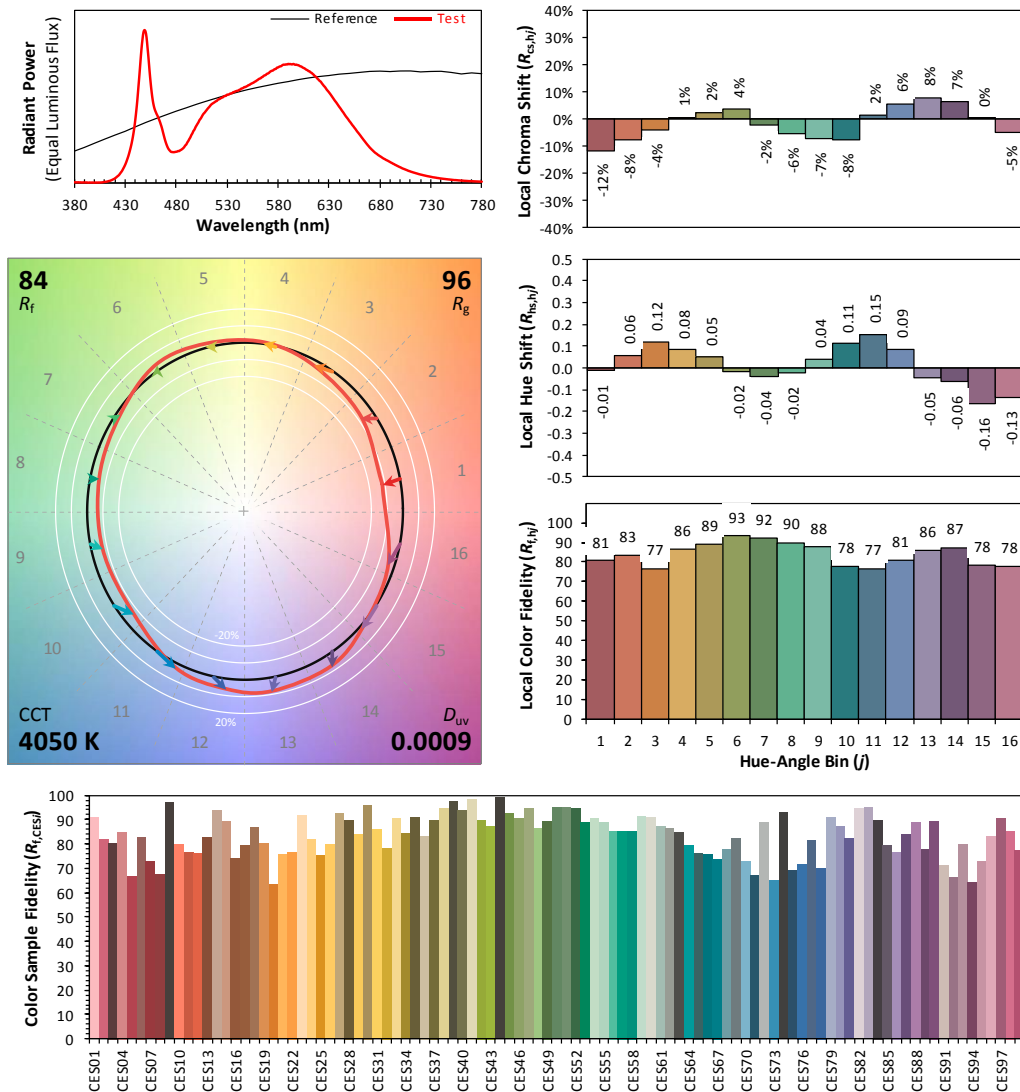
ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: Industrial Lighting Products, LLC

Date: 2025/03/18

Model: ULB2-20L-U-40-L2



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

x 0.3789
 y 0.3777
 u' 0.2237
 v' 0.5018

CIE 13.3-1995
 (CRI)

R_a 83
 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	114.56	4.15%
10- 20	325.841	11.81%
20- 30	483.063	17.50%
30- 40	549.632	19.91%
40- 50	503.795	18.25%
50- 60	371.539	13.46%
60- 70	223.072	8.08%
70- 80	131.82	4.78%
80- 90	43.808	1.59%
90-100	0.854	0.03%
100-110	1.728	0.06%
110-120	2.072	0.08%
120-130	2.072	0.08%
130-140	1.977	0.07%
140-150	1.791	0.06%
150-160	1.363	0.05%
160-170	0.817	0.03%
170-180	0.245	0.01%
Total	2760.0	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	2348.43	85.09%
60- 90	398.7	14.45%
0-90	2747.13	99.53%
90- 180	12.919	0.47%
0- 180	2760.0	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

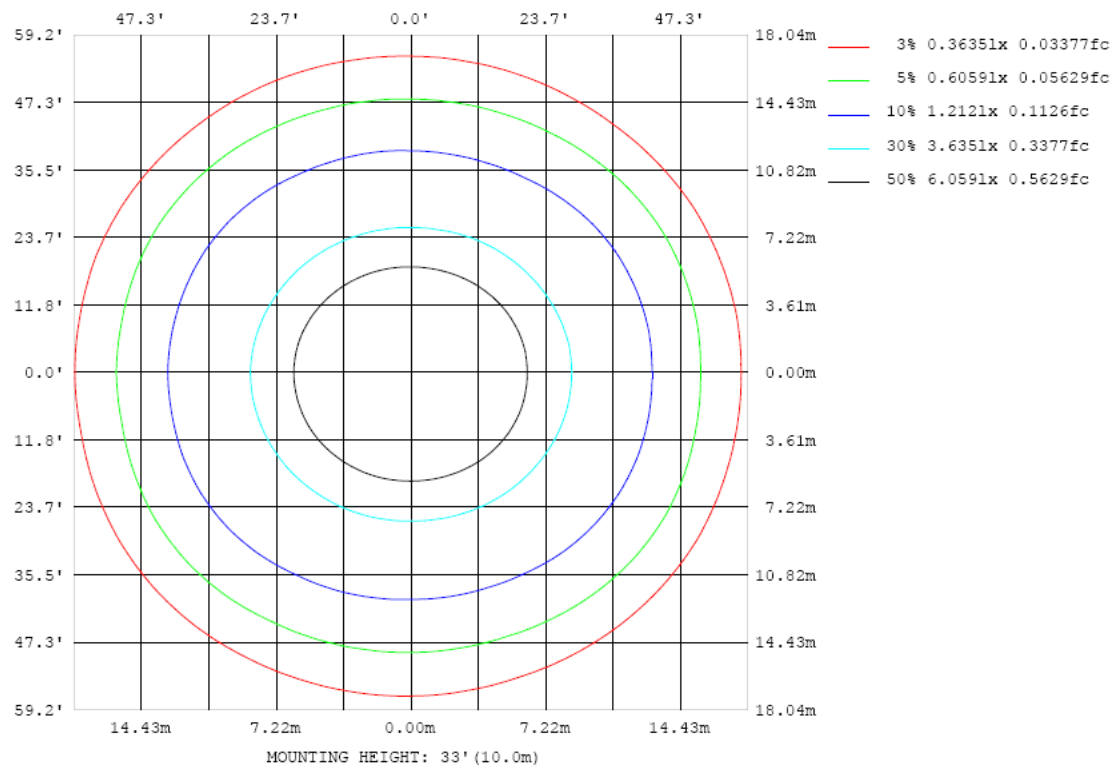


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

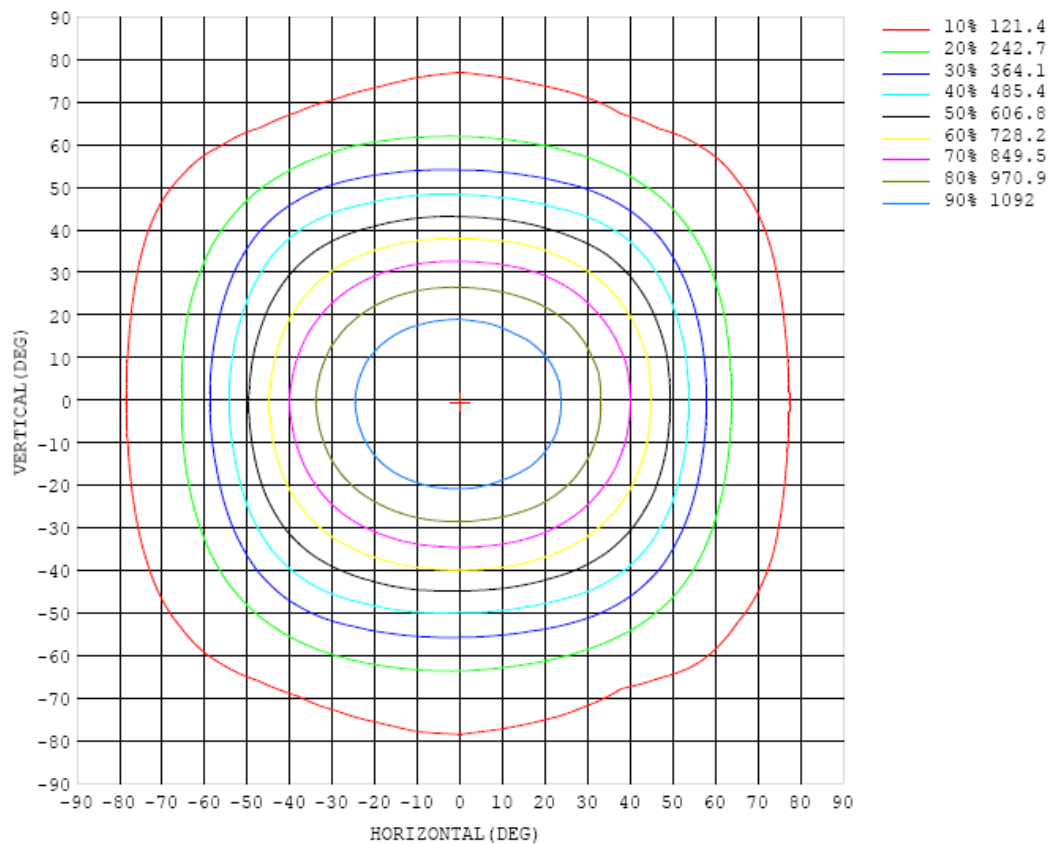


Chart 6: Isocandela Plot

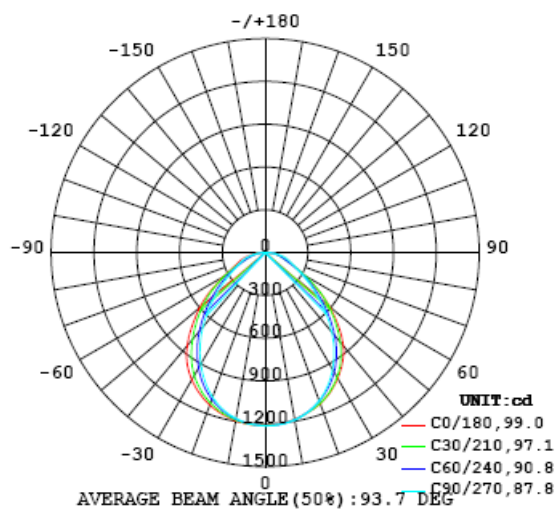


Chart 7: Polar Candela Distribution

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	1212	1212	1212	1212	1212	1212	1212	1212	1212	1212	1212	1212	1212	1212	1212	1212	1212	1212	1212
5	1206	1203	1205	1205	1207	1206	1207	1207	1209	1209	1210	1208	1208	1208	1210	1211	1208	1209	1209
10	1185	1187	1189	1190	1189	1189	1189	1188	1189	1192	1191	1189	1191	1193	1195	1194	1195	1196	1196
15	1160	1158	1161	1158	1158	1156	1155	1155	1157	1156	1157	1159	1160	1164	1167	1170	1168	1169	1170
20	1127	1128	1126	1123	1119	1111	1107	1104	1103	1104	1107	1108	1113	1120	1128	1131	1133	1137	1137
25	1079	1079	1079	1075	1068	1056	1045	1035	1033	1034	1036	1041	1050	1061	1071	1082	1084	1085	1088
30	1018	1017	1015	1006	996	981	967	953	944	945	948	956	967	983	998	1011	1018	1026	1030
35	942	943	934	922	906	887	871	854	845	841	846	853	868	885	907	925	937	946	951
40	851	847	837	819	799	776	758	742	728	727	731	742	756	776	799	817	833	845	852
45	725	725	716	699	680	657	633	617	606	603	612	625	642	664	688	705	718	723	724
50	589	592	591	580	562	539	512	494	486	483	494	507	524	551	576	593	600	597	600
55	446	449	455	452	440	420	400	384	379	379	384	394	408	433	452	465	465	461	466
60	316	317	319	321	315	306	297	290	289	291	294	299	309	324	335	341	338	333	338
65	226	225	223	220	214	211	214	220	224	229	230	230	230	230	232	238	244	248	250
70	179	175	164	154	145	141	153	169	180	187	186	181	167	155	153	161	175	191	199
75	141	135	122	119	115	111	118	130	143	152	149	137	123	116	115	121	128	142	158
80	95.9	95.6	85.2	84.7	87.8	83.9	87.0	90.5	97.9	106	103	88.4	83.3	80.2	78.1	84.9	86.2	96.6	103
85	45.8	50.7	48.7	43.2	45.1	39.7	46.0	47.5	52.0	49.0	51.3	45.4	41.7	37.6	36.6	40.5	41.9	45.3	44.1
90	1.79	1.54	2.46	3.12	3.89	5.21	4.36	4.73	4.00	3.37	3.60	4.96	5.68	5.24	2.72	0.63	0.52	0.18	0.10
95	0.16	0.18	0.24	0.30	0.45	0.48	0.66	0.82	0.93	0.76	0.99	1.02	1.00	0.86	0.78	0.63	0.40	0.22	0.23
100	0.53	0.54	0.54	0.57	0.75	0.93	1.27	1.31	1.18	0.87	1.16	1.55	1.76	1.63	1.43	1.18	0.89	0.74	0.67
105	0.88	0.92	0.91	1.07	1.40	1.58	1.96	1.77	1.40	1.18	1.59	2.01	2.18	2.24	2.45	2.12	1.87	1.79	1.73
110	1.39	1.61	1.30	1.81	2.25	2.52	2.18	2.10	1.82	1.65	2.07	2.25	2.63	2.60	2.08	1.88	2.12	2.24	2.09
115	1.00	1.63	1.77	2.33	2.11	2.26	2.32	2.20	2.08	2.05	2.40	2.69	2.75	2.77	2.53	2.06	1.86	1.68	1.50
120	1.69	1.59	1.75	1.96	1.99	2.31	2.37	2.42	2.33	2.41	2.77	3.03	2.93	2.92	2.63	2.59	2.17	2.01	1.50
125	1.79	1.65	2.05	1.96	2.20	2.23	2.41	2.48	2.53	2.74	3.05	3.27	3.16	2.75	2.86	2.62	2.64	2.39	2.51
130	2.14	1.59	2.23	2.12	2.45	2.34	2.44	2.39	2.47	2.83	3.04	3.09	3.13	3.20	2.87	2.53	2.70	2.31	2.37
135	2.18	1.70	2.53	2.37	2.16	2.67	2.65	2.69	2.79	3.04	3.36	3.42	3.35	3.36	2.93	2.89	2.89	2.23	2.70
140	2.24	1.89	2.57	2.57	2.47	2.29	2.69	2.88	2.93	3.18	3.49	3.50	3.37	3.30	3.29	3.15	3.07	1.71	2.88
145	2.56	2.39	2.35	2.51	2.52	2.71	2.70	2.68	2.79	3.16	3.45	3.40	3.53	3.59	3.57	3.24	3.23	1.84	3.14
150	2.24	2.19	1.66	2.74	2.88	2.85	2.74	2.78	2.92	3.17	3.58	3.57	3.68	3.68	3.37	3.52	3.14	2.22	3.35
155	2.80	3.00	2.17	2.35	2.93	2.97	2.78	2.92	3.06	3.19	3.40	3.59	3.41	3.54	3.73	3.63	2.18	2.85	3.63
160	2.95	3.12	2.46	2.03	2.47	2.87	3.02	3.04	3.08	3.16	3.19	3.52	3.67	3.78	3.79	2.96	2.29	3.46	3.50
165	2.76	2.86	2.67	2.19	1.99	2.30	2.54	2.77	2.95	3.11	3.20	3.34	3.34	3.24	2.43	2.35	2.60	3.66	3.65
170	2.73	2.75	2.80	2.64	2.25	2.03	1.89	1.93	2.08	2.02	2.05	1.97	1.98	2.20	2.31	2.79	3.52	3.58	3.52
175	2.15	2.28	2.33	2.26	2.20	2.15	2.12	2.12	2.00	1.99	2.05	2.35	2.62	2.89	3.21	3.26	3.26	3.30	3.27
180	2.37	2.38	2.35	2.35	2.50	2.47	2.41	2.41	2.48	2.75	2.68	2.52	2.38	2.32	2.42	2.20	2.06	2.04	2.33

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	1212	1212	1212	1212	1212	1212	1212	1212	1212	1212	1212	1212	1212	1212	1212	1212	1212		
5	1206	1207	1209	1207	1205	1205	1203	1205	1206	1202	1201	1202	1203	1205	1206	1204	1207		
10	1193	1191	1190	1188	1184	1183	1179	1180	1181	1180	1179	1180	1180	1184	1185	1184	1185		
15	1168	1166	1161	1157	1151	1147	1142	1140	1137	1139	1138	1140	1145	1148	1152	1156	1161		
20	1131	1129	1123	1113	1101	1093	1083	1080	1078	1077	1078	1085	1092	1104	1114	1118	1125		
25	1084	1076	1066	1053	1037	1024	1009	1001	999	999	1003	1014	1029	1046	1060	1071	1080		
30	1021	1011	994	974	952	935	919	908	903	905	911	930	949	970	992	1003	1015		
35	943	925	904	878	852	832	813	802	796	798	811	830	853	877	901	922	940		
40	837	816	791	768	742	718	699	687	681	683	696	717	740	767	796	822	847		
45	713	699	679	658	630	601	582	569	560	561	570	588	618	651	677	702	722		
50	590	580	567	545	517	487	467	456	446	445	453	469	499	532	558	576	592		
55	459	454	447	427	405	381	363	352	346	346	351	363	385	409	428	438	447		
60	334	335	327	314	299	287	277	270	266	266	266	270	277	290	304	310	316		
65	251	241	225	212	207	208	211	212	212	208	203	197	193	195	206	218	227		
70	195	172	153	140	140	150	164	173	176	169	159	148	136	136	145	159	175		
75	145	124	112	107	107	107	116	131	139	130	119	113	108	110	114	120	132		
80	96.9	83.2	76.9	67.9	65.9	69.0	70.2	85.1	87.7	85.0	78.2	78.5	76.2	80.3	81.8	82.3	93.3		
85	44.7	37.4	32.2	30.3	25.6	27.0	28.0	33.0	30.7	34.9	33.7	35.4	31.9	37.4	38.6	44.5	51.5		
90	0.09	0.21	0.36	0.51	0.81	1.89	1.47	0.67	0.58	0.67	2.43	2.90	2.84	2.11	1.08	0.76	0.63		
95	0.24	0.36	0.52	0.62	0.71	0.88	0.86	0.95	0.61	0.90	0.80	0.70	0.54	0.52	0.42	0.32	0.23		
100	0.78	0.92	1.13	1.41	1.76	1.90	1.56	1.12	0.86	1.11	1.53	1.40	1.10	0.90	0.75	0.53	0.66		
105	1.84	2.01	2.22	2.50	2.27	2.08	1.89	1.38	1.12	1.34	1.82	2.29	1.93	1.67	1.35	0.95	1.02		
110	2.30	2.21	2.00	2.12	2.41	2.31	1.91	1.71	1.46	1.61	1.95	2.19	2.37	2.30	1.91	1.47	1.68		
115	1.65	1.80	1.89	2.26	2.49	2.27	2.03	1.95	1.76	1.78	1.99	2.11	2.16	1.99	2.17	1.72	1.62		
120	1.49	2.09	1.83	2.20	2.42	2.31	2.28	2.17	2.09	2.03	2.05	2.13	2.15	2.01	1.90	1.90	1.65		
125	2.36	2.54	2.36	2.02	2.25	2.28	2.49	2.37	2.33	2.17	2.05	2.23	2.06	2.17	2.05	1.94	1.73		
130	1.99	2.56	2.51	2.30	2.11	2.57	2.47	2.34	2.30	2.12	2.02	2.28	2.19	2.10	2.07	2.25	1.91		
135	2.38	2.30	2.69	2.57	2.93	2.29	2.29	2.76	2.62	2.45	2.25	2.25	2.32	2.13	2.24	2.30	1.91		
140	2.54	3.04	3.00	3.11	2.90	3.07	2.79	2.45	2.42	2.37	2.44	2.75	2.40	2.55	2.68	2.48	2.07		
145	3.03	3.05	2.49	3.31	3.41	3.26	3.00	3.03	2.34	2.70	2.57	2.58	2.76	2.68	2.25	2.64	2.67		
150	3.36	2.96	3.62	2.48	3.39	3.44	3.27	3.00	2.39	2.40	2.61	2.66	2.92	2.62	2.57	2.32	2.28		
155	3.73	3.47	3.15	3.59	2.50	3.02	3.15	2.99	2.51	2.70	2.50	2.43	2.38	2.58	2.83	2.62	3.00		
160	3.56	3.50	3.21	3.27	3.70	3.34	2.61	2.42	2.34	2.47	2.49	2.56	2.54	2.37	2.28	2.88	3.21		
165	3.61	3.69	3.49	3.45	3.19	3.26	3.25	3.14	2.71	2.53	2.80	2.38	2.18	2.19	2.55	2.70	2.65		
170	3.48	3.50	3.58	3.54	3.45	3.38	3.15	2.90	2.56	2.06	2.10	2.04	2.03	2.11	2.12	2.24	2.39		
175	3.28	3.26	3.24	3.18	3.09	3.04	2.76	2.63	2.11	2.10	2.07	2.13	2.16	2.15	2.19	2.23	2.38		
180	2.32	2.36	2.37	2.41	2.44	2.41	2.45	2.38	2.51	2.56	2.53	2.39	2.45	2.42	2.44	2.39	2.36		

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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