



LM-79-08 Test Report

for

Philips (China) Investment Co., Ltd.

Building 9, Lane 888, Tianlin Road
Shanghai, China

InstantFit LEDtube

Model: 9290011810(2 lamps+ballast ICF-2S26-H1-LD)

Laboratory: Leading Testing Laboratories

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Report No.: HZ15080001a

Review by:

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Engineer: April Zou
Aug. 06, 2015

Approved by:



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Manager: Jim Zhang
Aug. 06, 2015

Test Summary

Sample Tested: 9290011810(2 lamps+ballast ICF-2S26-H1-LD)

Photometric and Electrical Measurements for two lamps

Voltage (V AC)	Current (A)	Test power (W) (ballast + 2 tubes)	Power Factor	Total Luminous Flux (lm)	Luminous Efficacy (lm/W)	Total Harmonic Distortion
120.0	0.172	20.58	0.9958	1955.9	95.0	5.89

Photometric and Colorimetric Measurements for each lamp

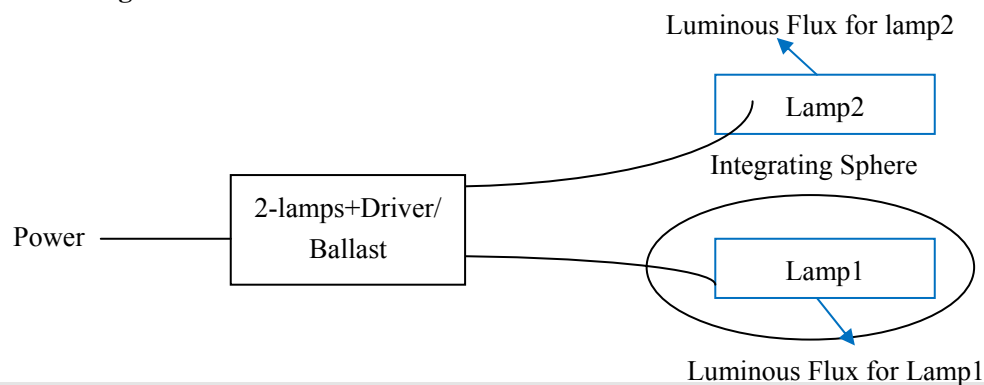
Sample Number	Luminous Flux(lm)	Correlated Color Temperature (K)	Color Rendering Index Ra
1#	977.6	3961	83.8
2#	978.3	3956	83.8
Sample Number	Color Rendering Index R9	Chromaticity Coordinate x	Chromaticity Coordinate y
1#	10.4	0.3821	0.3778
2#	10.2	0.3822	0.3777

Table 1: Executive Data Summary

Note: The above results are recorded/ derived from measurements made using an Integrating Sphere.

Luminous Efficacy= (Luminous Flux for lamp1+ Luminous Flux for lamp2)/Power

Test figure is shown as following:



Test specifications:

Date of Receipt : Aug. 03, 2015

Date of Test : Aug. 04, 2015 to Aug. 05, 2015

Test item : Total Luminous Flux, Luminous Distribution Intensity, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters

Reference Standard : IESNA LM-79-2008 Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products

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Figure 1- Overview of the sample

Equipment Under Test (EUT)

Name	: InstantFit LEDtube
Model	: 9290011810(2 lamps+ballast ICF-2S26-H1-LD)
Electrical Ratings	: 120Vac, 60Hz, 10.5W
Product Description	: 4000K, Frosted Plastic lens LED lamps supplied by a high frequency fluorescent lamp ballast: Philips ICF-2S26-H1-LD
Manufacturer	: Philips (China) Investment Co., Ltd.
Address	: Building 9, Lane 888, Tianlin Road Shanghai, China

TEST RESULTS

Test ambient temperature was 25.4°C.

Base orientation was Horizontal. Test was conducted without a dimmer in the circuit.

The stabilization time of the sample was 65 minutes, and the total operating time including stabilization was 70 minutes.

Sphere-Spectroradiometer Method

Parameter	Result	
	1#	2#
Test Voltage (V)	120.0	
Voltage frequency (Hz)	60	
Test Current (A)	0.172	
Power Factor	0.9958	
Test power (W) (ballast + 2 tubes)	20.58	
THD A%	5.89	
Luminous Efficacy (lm/W)	95.0	
Total Luminous Flux (lm)	977.6	978.3
Color Rendering Index (CRI)	83.8	83.8
R9	10.4	10.2
Correlated Color Temperature (CCT) (K)	3961	3956
Chromaticity Chroma x	0.3821	0.3822
Chromaticity Chroma y	0.3778	0.3777
Chromaticity Chroma u	0.2258	0.2259
Chromaticity Chroma v	0.3349	0.3348
Duv	0.0000	0.0001
Chromaticity Chroma u'	0.2258	0.2259
Chromaticity Chroma v'	0.5023	0.5023

Special Color Rendering Indices		
	1#	2#
R1	82.8	82.7
R2	92.9	92.8
R3	95.3	95.4
R4	80.3	80.4
R5	82.7	82.6
R6	89.3	89.2
R7	84.1	84.2
R8	63.4	63.3
R9	10.4	10.2
R10	82.5	82.2
R11	79.3	79.3
R12	65.6	65.6
R13	85.8	85.7
R14	98.1	98.1

Table 2: Test data per Sphere-Spectroradiometer Method

Note: According to CIE 1976 (u' , v') diagram, $u' = u = 4x/(-2x+12y+3)$, $v' = 3v/2 = 9y/(-2x+12y+3)$.

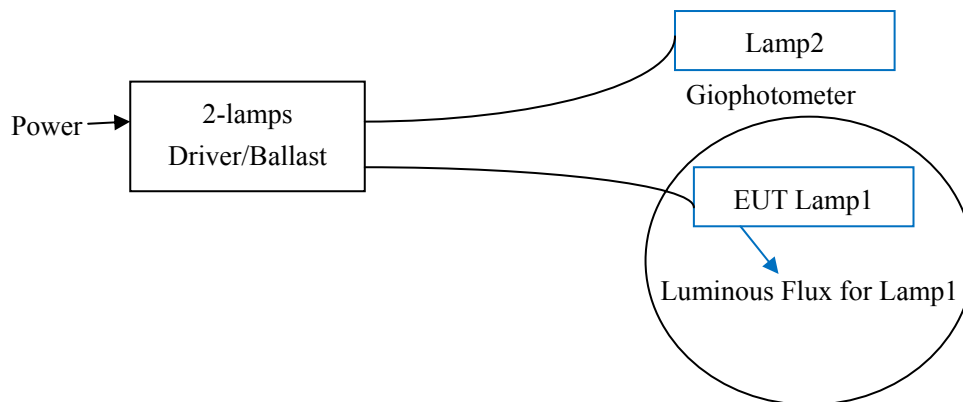
Goniophotometer Method

Test ambient temperature was 25.2°C.

The photometric distance is 2.475m.

Luminous data was taken at 0.5°vertical intervals and 10°horizontal intervals.

Test figure is shown as following:



Note: One lamp was tested in Giophotometer system. The total electrical input data was recorded before the ballast and divided by 2 in table below to be used as the input data of the tested one lamp.

Parameter	Result
Test Voltage (V)	120.0
Voltage frequency (Hz)	60
Test Current (A)	0.174
Power Factor	0.9904
Test Power (W) (ballast + 2 tubes)/2	10.31
Luminous Efficacy (lm/W)	94.4
Total Luminous Flux (lm) (Single tube)	972.8
Beam Angle (°)	110.9 (0°-180°)/ 123.8 (90°-270°)
Center Beam Candle Power (cd)	295
Maximum Beam Candle Power (cd)	295.7 (At: C=160.0, Gamma=1.5)
Spacing Criteria	1.25 (0°-180°)/ 1.29 (90°-270°)
Zonal Lumens in the 0°-60°Zone	69.63%
Zonal Lumens in the 60°-90°Zone	24.81%
Zonal Lumens in the 90°-120°Zone	4.83%
Zonal Lumens in the 120°-180°Zone	0.73%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution of 1# tube - Sphere Spectroradiometer Method

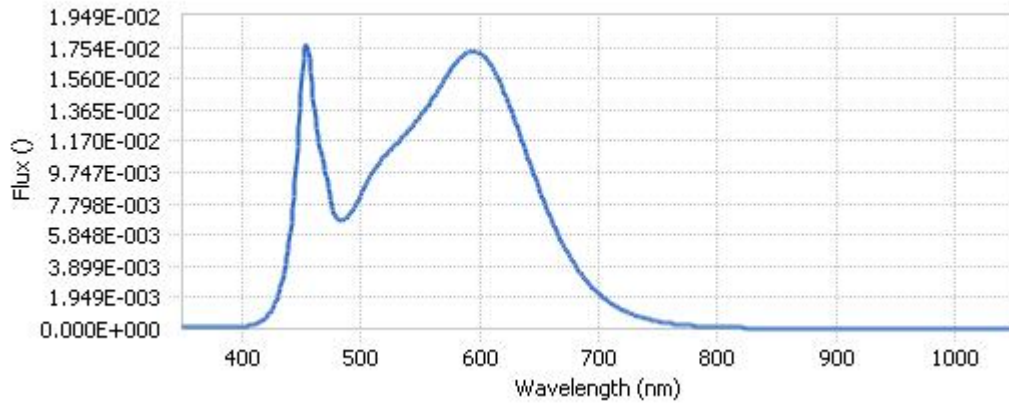
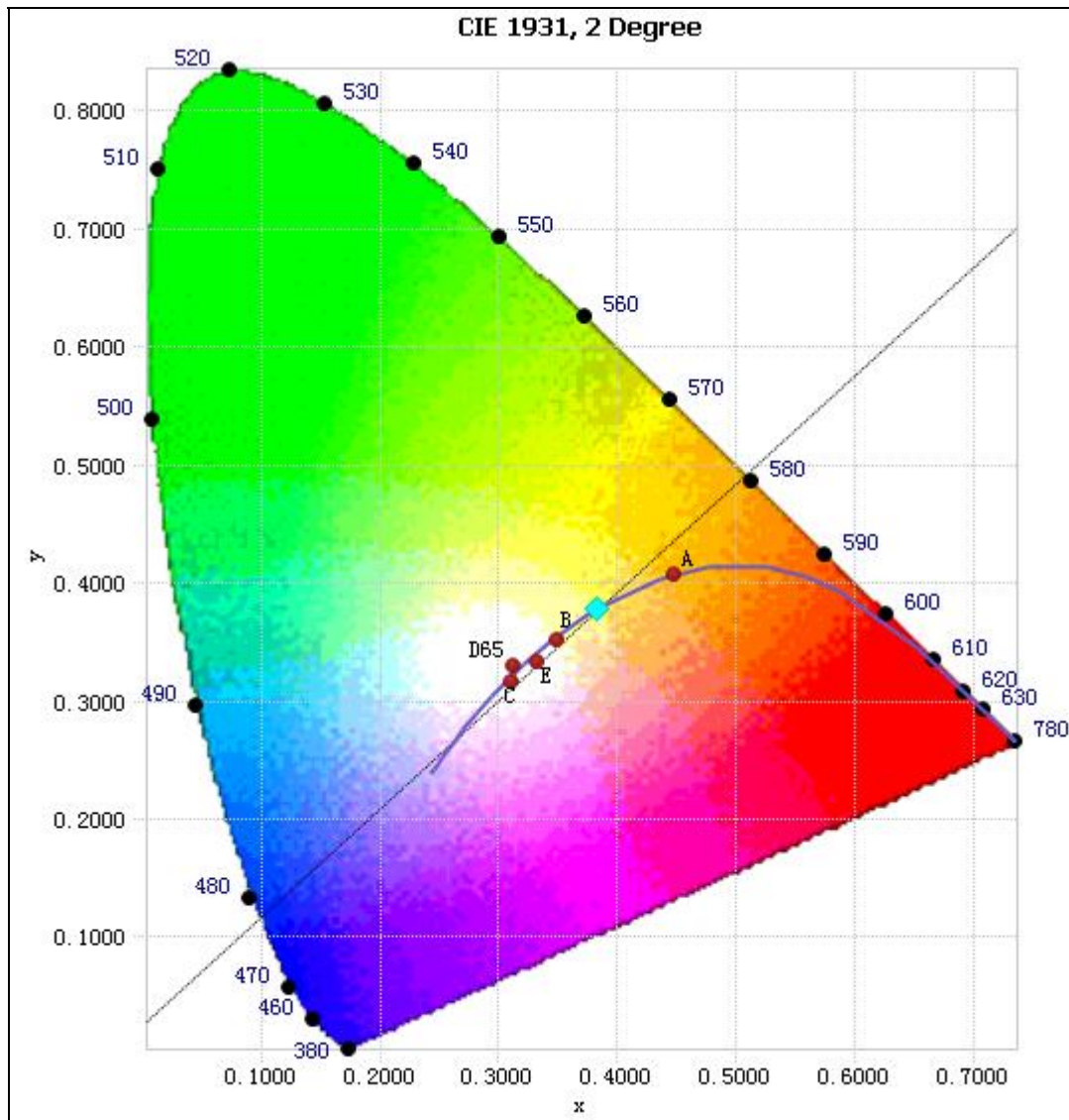


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.48E-04	485	6.80E-03	590	1.73E-02	695	2.55E-03
385	1.31E-04	490	7.06E-03	595	1.73E-02	700	2.19E-03
390	1.34E-04	495	7.58E-03	600	1.72E-02	705	1.88E-03
395	1.46E-04	500	8.31E-03	605	1.69E-02	710	1.61E-03
400	1.51E-04	505	9.06E-03	610	1.64E-02	715	1.37E-03
405	1.77E-04	510	9.72E-03	615	1.57E-02	720	1.18E-03
410	2.56E-04	515	1.03E-02	620	1.48E-02	725	1.01E-03
415	4.05E-04	520	1.07E-02	625	1.39E-02	730	8.57E-04
420	6.74E-04	525	1.12E-02	630	1.29E-02	735	7.31E-04
425	1.17E-03	530	1.15E-02	635	1.19E-02	740	6.27E-04
430	1.98E-03	535	1.19E-02	640	1.08E-02	745	5.38E-04
435	3.36E-03	540	1.24E-02	645	9.75E-03	750	4.62E-04
440	5.39E-03	545	1.28E-02	650	8.75E-03	755	3.98E-04
445	9.25E-03	550	1.32E-02	655	7.79E-03	760	3.37E-04
450	1.48E-02	555	1.37E-02	660	6.87E-03	765	2.92E-04
455	1.76E-02	560	1.43E-02	665	6.03E-03	770	2.53E-04
460	1.44E-02	565	1.49E-02	670	5.26E-03	775	2.13E-04
465	1.16E-02	570	1.55E-02	675	4.57E-03	780	1.84E-04
470	9.87E-03	575	1.60E-02	680	3.98E-03		
475	7.97E-03	580	1.66E-02	685	3.45E-03		
480	6.88E-03	585	1.69E-02	690	2.96E-03		

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

Chromaticity Diagram of 1# tube - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3821, 0.3778)

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 of 1# tube – Sphere Spectroradiometer Method

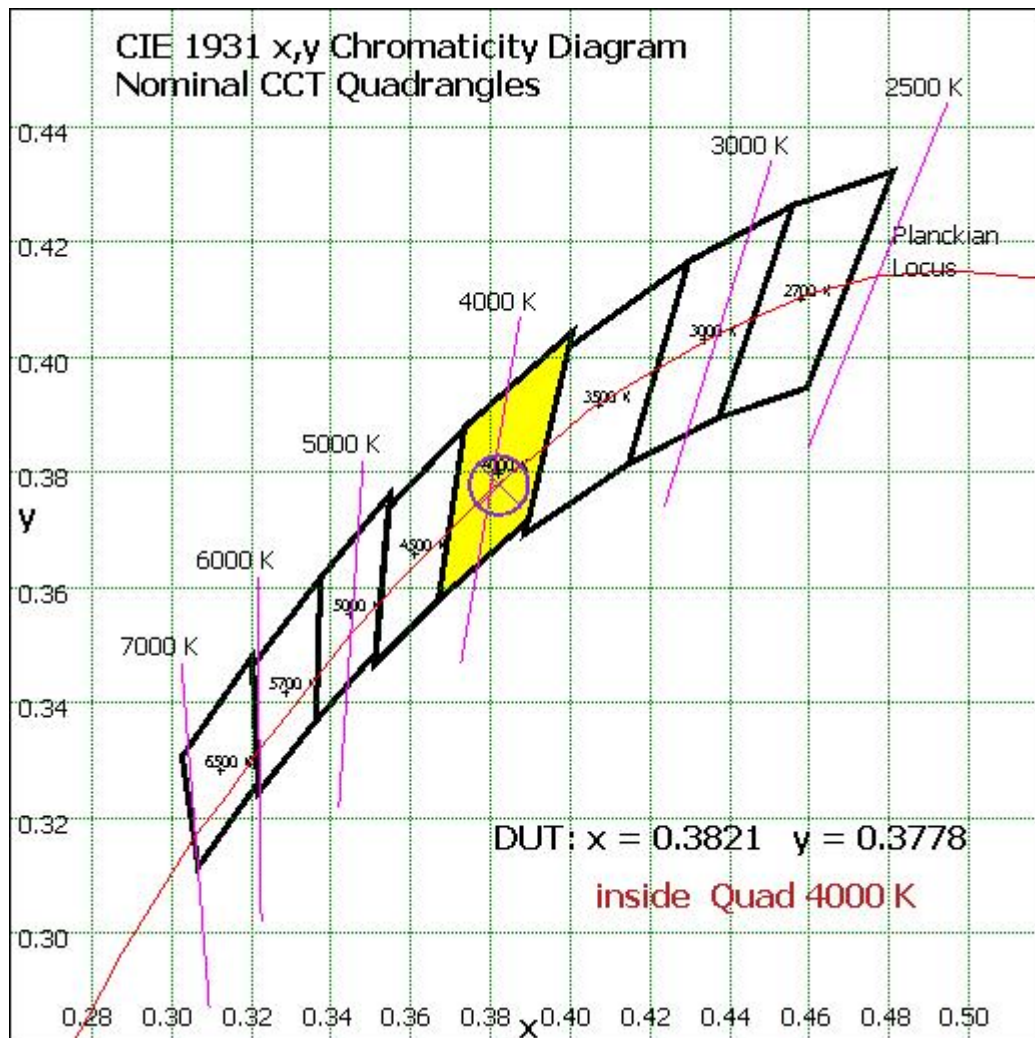


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

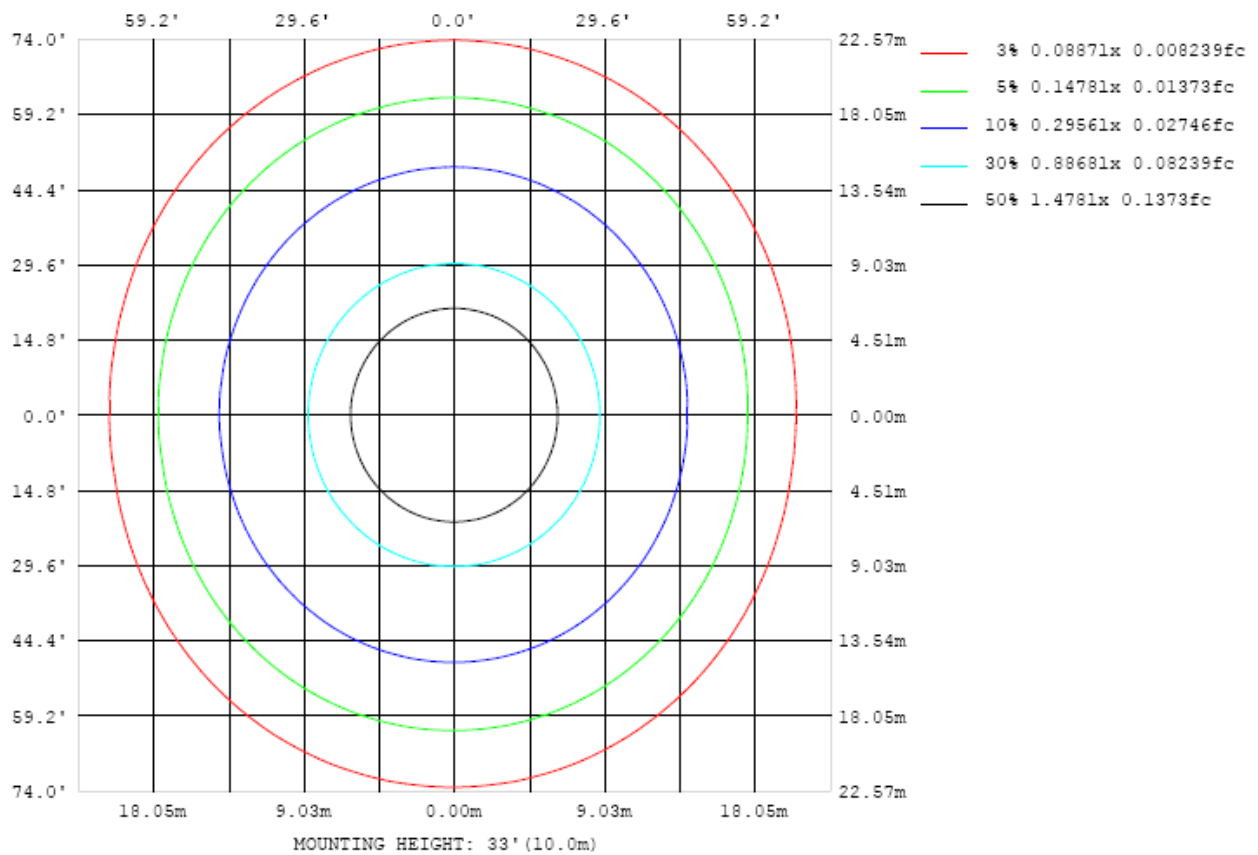
Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	27.95	2.87%
10- 20	80.079	8.23%
20- 30	121.61	12.50%
30- 40	147.548	15.17%
40- 50	155.308	15.97%
50- 60	144.864	14.89%
60- 70	118.257	12.16%
70- 80	80.338	8.26%
80- 90	42.784	4.40%
90-100	23.568	2.42%
100-110	14.758	1.52%
110-120	8.617	0.89%
120-130	4.442	0.46%
130-140	1.821	0.19%
140-150	0.509	0.05%
150-160	0.189	0.02%
160-170	0.087	0.01%
170-180	0.028	0.00%
Total	972.8	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	677.359	69.63%
60- 90	241.379	24.81%
0-90	918.738	94.45%
90- 180	54.019	5.55%
0- 180	972.8	100%

Table 5: Zonal Lumen Data

Illuminance Plots- Goniophotometer Method



Luminous Intensity Distribution Plots- Goniophotometer Method

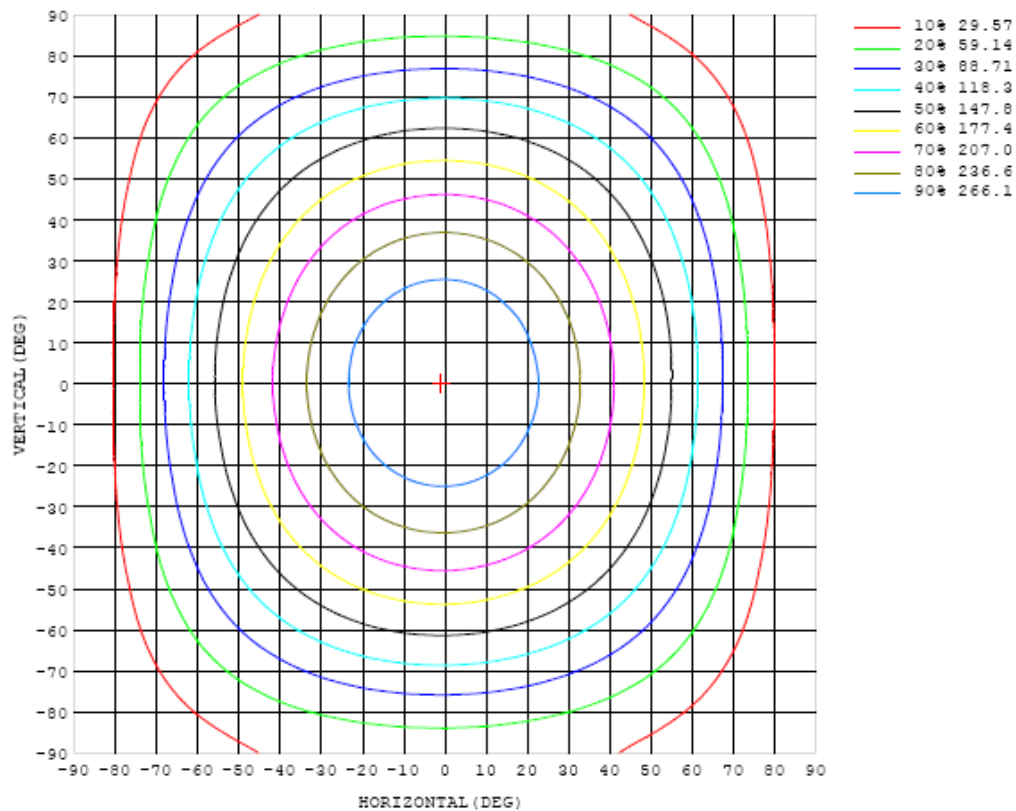


Chart 5: Isocandela Plot

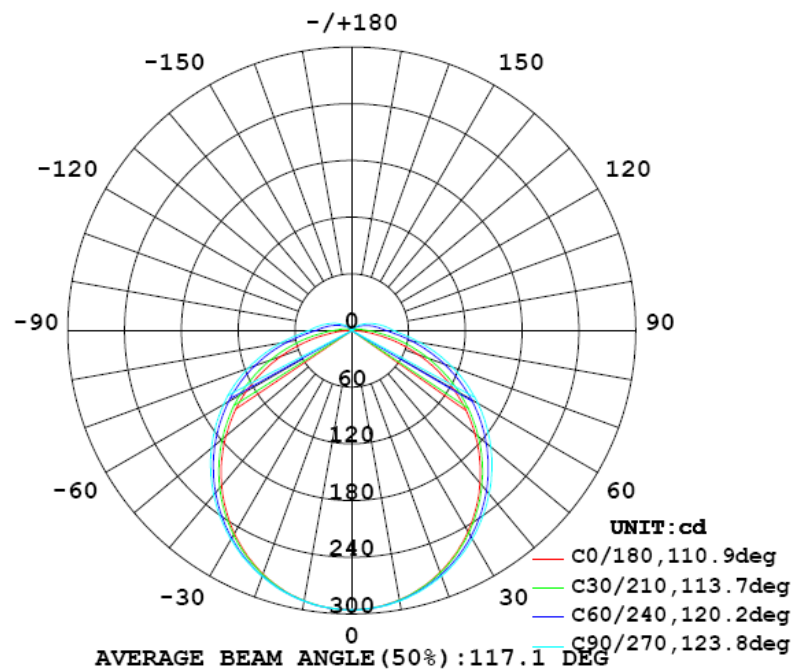


Chart 6: Polar Candela Distribution

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	295	295	295	295	295	295	295	295	295	295	295	295	295	295	295	295	295	295	295
5	294	294	294	294	294	294	294	294	294	294	294	294	294	294	294	294	294	294	294
10	289	289	289	290	290	290	290	290	291	291	291	291	291	290	291	290	290	290	290
15	282	282	282	283	283	283	284	284	284	285	284	285	284	284	284	284	284	283	283
20	272	272	272	273	274	274	275	276	276	277	276	276	276	276	275	275	274	274	274
25	260	260	260	261	262	263	264	265	266	266	266	266	265	265	264	263	263	262	262
30	245	246	246	247	248	250	252	253	254	255	254	254	253	252	251	250	249	248	248
35	229	229	230	231	233	235	237	239	240	241	241	240	239	237	236	234	233	232	232
40	211	211	212	214	216	219	221	223	225	226	225	225	223	221	219	217	215	214	214
45	191	191	192	195	197	201	204	206	208	209	209	208	206	203	201	198	196	195	195
50	170	170	172	174	178	182	185	188	191	192	191	190	188	185	181	178	176	174	174
55	148	148	150	153	157	162	166	169	172	173	173	171	168	165	161	157	154	152	152
60	124	124	127	131	136	141	146	150	152	154	153	151	148	144	140	135	131	128	129
65	99.7	100	104	109	114	120	125	129	132	134	133	131	128	123	118	113	108	105	104
70	75.0	76.1	80.2	86.0	92.3	98.5	104	109	112	113	113	110	107	102	96.2	90.2	84.7	80.2	79.7
75	51.2	52.9	58.0	64.4	70.9	77.7	83.5	88.1	91.3	92.6	92.0	89.9	86.0	80.9	74.8	68.3	62.3	57.0	55.0
80	28.6	30.9	37.1	44.5	51.8	58.7	64.4	68.7	71.7	72.9	72.4	70.2	66.6	61.6	55.4	48.4	41.3	34.9	32.1
85	10.9	13.6	20.3	27.8	35.1	41.9	47.6	52.1	55.0	56.0	55.4	53.3	49.6	44.4	38.1	31.1	23.9	17.2	14.0
90	0.89	3.91	10.5	17.6	24.6	31.1	36.6	40.8	43.5	44.4	43.8	41.8	38.1	32.9	26.8	20.0	13.0	6.55	2.72
95	0.08	1.54	5.92	12.1	18.6	24.8	30.2	34.3	37.0	38.0	37.5	35.4	31.7	26.7	20.8	14.4	8.00	2.91	0.82
100	0.10	0.82	3.64	8.57	14.2	19.8	24.8	28.6	31.2	32.2	31.6	29.6	26.2	21.6	16.2	10.5	5.29	1.70	0.81
105	0.12	0.47	2.22	5.91	10.8	15.7	20.1	23.6	26.0	26.9	26.4	24.5	21.4	17.3	12.5	7.73	3.62	1.26	0.80
110	0.13	0.40	1.51	4.18	7.92	12.2	16.1	19.2	21.3	22.1	21.6	20.0	17.3	13.7	9.62	5.66	2.47	1.06	0.77
115	0.14	0.33	1.06	2.94	5.85	9.19	12.4	15.2	17.1	17.8	17.4	16.0	13.7	10.6	7.27	4.11	1.46	0.81	0.75
120	0.15	0.21	0.61	1.87	4.26	6.88	9.48	11.7	13.2	13.9	13.7	12.6	10.6	8.09	5.39	2.41	1.25	0.74	0.73
125	0.16	0.21	0.37	1.02	2.56	5.06	7.10	8.86	10.1	10.6	10.5	9.57	8.01	6.00	3.45	1.55	0.95	0.71	0.70
130	0.16	0.22	0.31	0.65	1.38	2.80	5.15	6.53	7.50	7.93	7.77	7.05	5.83	3.60	1.62	1.20	0.78	0.68	0.69
135	0.19	0.23	0.28	0.45	0.84	1.52	2.50	3.79	5.14	5.62	5.43	4.42	2.89	1.75	1.34	0.89	0.68	0.65	0.68
140	0.21	0.22	0.27	0.35	0.56	0.87	1.40	1.88	2.27	2.51	2.41	2.00	1.67	1.30	0.91	0.72	0.63	0.62	0.66
145	0.23	0.21	0.27	0.31	0.41	0.59	0.80	1.06	1.28	1.38	1.36	1.26	1.06	0.85	0.70	0.61	0.59	0.58	0.58
150	0.23	0.22	0.26	0.29	0.33	0.41	0.52	0.63	0.71	0.76	0.76	0.70	0.65	0.57	0.51	0.48	0.47	0.45	0.45
155	0.24	0.23	0.24	0.25	0.30	0.33	0.36	0.40	0.43	0.47	0.47	0.45	0.43	0.40	0.39	0.39	0.40	0.40	0.42
160	0.25	0.24	0.25	0.26	0.28	0.29	0.30	0.31	0.32	0.33	0.33	0.34	0.34	0.34	0.35	0.36	0.37	0.38	0.39
165	0.26	0.26	0.26	0.27	0.28	0.28	0.28	0.28	0.29	0.29	0.29	0.29	0.30	0.30	0.31	0.34	0.35	0.36	0.36
170	0.27	0.27	0.27	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.29	0.30	0.29	0.30	0.32	0.33	0.35
175	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.28	0.28	0.29	0.29	0.29	0.29	0.29	0.30	0.30	0.31	0.31
180	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.28	0.26	0.29	0.27

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	295	295	295	295	295	295	295	295	295	295	295	295	295	295	295	295	295		
5	294	294	294	294	294	294	294	294	294	294	294	294	294	294	294	294	293		
10	290	290	290	290	291	291	291	291	291	291	290	290	290	290	290	290	289		
15	283	283	284	284	285	285	285	285	285	284	284	284	283	283	283	283	282		
20	274	274	275	275	276	277	277	277	277	277	276	276	275	274	273	273	272		
25	262	263	263	264	265	266	266	267	267	267	266	265	264	263	262	261	260		
30	248	249	250	251	253	254	254	255	255	255	254	253	251	249	248	247	246		
35	232	233	234	236	238	240	241	242	242	241	240	239	236	234	232	231	229		
40	214	215	217	219	222	224	225	227	227	226	225	223	220	218	215	213	211		
45	195	196	198	201	204	207	209	211	211	210	208	206	203	199	196	194	192		
50	174	176	179	182	186	189	191	193	193	193	191	188	184	180	176	173	171		
55	153	155	158	162	166	170	173	175	175	174	172	169	165	160	156	152	149		
60	130	132	137	141	146	150	154	156	156	155	153	150	145	140	134	130	126		
65	106	109	114	120	125	130	134	136	137	136	133	129	124	118	112	107	102		
70	81.3	85.7	91.6	97.8	104	109	113	116	117	116	113	108	103	96.4	89.7	83.4	78.2		
75	57.3	62.7	69.5	76.4	82.9	88.5	92.6	95.3	96.1	95.1	92.2	87.6	81.7	75.0	67.8	60.7	54.6		
80	35.0	41.4	48.8	56.1	62.9	68.6	72.8	75.5	76.3	75.2	72.4	67.8	61.9	54.9	47.4	39.7	32.7		
85	17.1	23.7	31.3	38.6	45.3	51.0	55.1	57.6	58.3	57.3	54.6	50.3	44.5	37.8	30.2	22.4	15.5		
90	5.91	12.2	19.4	26.5	32.9	38.4	42.4	44.8	45.5	44.6	42.1	38.1	32.6	26.2	19.2	12.0	5.30		
95	2.40	7.13	13.6	20.2	26.4	31.7	35.7	38.1	38.8	38.0	35.5	31.6	26.3	20.1	13.5	7.04	2.14		
100	1.37	4.61	9.68	15.5	21.1	26.0	29.7	32.1	32.8	32.0	29.7	26.0	21.1	15.5	9.63	4.48	1.16		
105	1.20	3.11	7.02	11.8	16.8	21.1	24.5	26.6	27.3	26.6	24.5	21.1	16.7	11.8	6.94	2.94	0.64		
110	0.99	2.07	5.09	8.95	13.1	16.9	19.9	21.8	22.4	21.7	19.9	16.9	13.0	8.89	4.98	1.64	0.32		
115	0.81	1.59	3.66	6.71	10.1	13.2	15.8	17.5	18.0	17.4	15.8	13.2	10.0	6.62	3.53	1.01	0.26		
120	0.75	1.15	2.32	4.95	7.61	10.2	12.3	13.7	14.1	13.6	12.2	10.1	7.54	4.85	2.08	0.64	0.25		
125	0.71	0.90	1.64	3.51	5.63	7.65	9.33	10.4	10.8	10.4	9.30	7.59	5.54	3.29	1.03	0.25	0.16		
130	0.68	0.76	1.16	1.81	4.01	5.60	6.90	7.77	8.05	7.75	6.87	5.54	3.94	1.72	0.63	0.20	0.15		
135	0.67	0.69	0.88	1.38	2.00	3.66	4.92	5.58	5.81	5.57	4.89	3.69	1.98	1.05	0.42	0.20	0.18		
140	0.64	0.64	0.72	0.97	1.44	1.79	2.24	3.06	3.39	2.79	1.87	1.57	1.15	0.68	0.32	0.21	0.20		
145	0.59	0.59	0.62	0.74	0.96	1.19	1.36	1.45	1.40	1.10	1.21	1.01	0.70	0.46	0.30	0.23	0.25		
150	0.45	0.47	0.50	0.55	0.65	0.76	0.84	0.91	0.93	0.84	0.73	0.60	0.48	0.35	0.29	0.26	0.26		
155	0.41	0.41	0.39	0.39	0.43	0.46	0.51	0.54	0.53	0.55	0.44	0.41	0.36	0.31	0.28	0.28	0.27		
160	0.38	0.38	0.37	0.36	0.35	0.35	0.36	0.35	0.36	0.36	0.33	0.32	0.30	0.29	0.29	0.28	0.28		
165	0.36	0.36	0.35	0.34	0.33	0.32	0.31	0.30	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29		
170	0.35	0.35	0.34	0.33	0.32	0.32	0.30	0.30	0.29	0.29	0.29	0.29	0.29	0.30	0.29	0.29	0.29		
175	0.31	0.31	0.31	0.31	0.30	0.30	0.29	0.29	0.29	0.28	0.28	0.28	0.28	0.28	0.29	0.29	0.29		
180	0.28	0.28	0.28	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.28	0.28		

Table 7: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Sep. 18, 2014	Sep. 17, 2015
Digital Power Meter	PF2010A	HZTE028-01	Sep. 18, 2014	Sep. 17, 2015
AC Power Supply	PCR 500L	HZTE001-08	Sep. 18, 2014	Sep. 17, 2015
DC Power Supply	WY12010	HZTE004-03	Sep. 18, 2014	Sep. 17, 2015
Temperature Meter	TES1310	HZTE017-01	Sep. 18, 2014	Sep. 17, 2015
Standard source	D908	HZTE012-01	Sep. 18, 2014	Sep. 17, 2015
Integrate Sphere system	2M	HZTE015-01	Sep. 18, 2014	Sep. 17, 2015
Digital Power Meter	WT210	HZTE008-01	Sep. 18, 2014	Sep. 17, 2015
AC Power Supply	PCR 500L	HZTE001-07	Sep. 18, 2014	Sep. 17, 2015
DC Power Supply	6154	HZTE004-04	Sep. 18, 2014	Sep. 17, 2015
Temperature and humidity recorder	JR900	HZTE018-01	Sep. 18, 2014	Sep. 17, 2015
Standard source	SCL-1400	HZTE012-02	Sep. 18, 2014	Sep. 17, 2015
Fluorescent Ballast Analyzer	HB-6B	HZTE002-01	Sep. 18, 2014	Sep. 17, 2015

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 Two 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 lamps) 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 30 min, taken 15 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 expended uncertainty is 1.06% 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 lamps) 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 30 min, taken 15 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 1.94% with a coverage factor $k=2$.

Color Characteristics Measurements

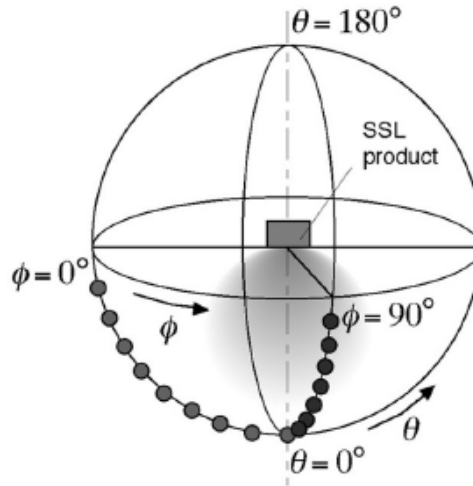
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as 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.

Color Spatial Uniformity

The characteristics of SSL products may be spatially non-uniform, the chromaticity coordinate shall be measured at two vertical planes ($C=0^\circ/180^\circ$ and $C=90^\circ/270^\circ$) and at 10° or less intervals for vertical angle until the light output dropped to below 10% of the peak intensity. The averaged weighted chromaticity coordinate was calculated from these points. The data was then analyzed to check for delta color differences of the u' , v' chromaticity coordinates. The spatial non-uniformity of chromaticity, $\Delta u'v'$, is determined as the maximum deviation (distance on the CIE (u' , v') diagram) among all measured points from the spatially averaged

chromaticity coordinate.

The geometry for the chromaticity measurement using gonio-spectroradiometer is shown as following.



*** End of Report ***

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