



## LM-79-08 Test Report

for

**Philips (China) Investment Co., Ltd.**

Building 9, Lane 888, Tianlin Road  
Shanghai, China

**InstantFit LEDtube**

**Model: 9290002841**

**Laboratory: Leading Testing Laboratories**

**NVLAP CODE: 200960-0**

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Report No.: HZ13090016a/R1

This report added Giophotometer test data to old report HZ13090016a dated Oct.12, 2013.

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

Review by:

*April Zou*

Engineer: April Zou  
Oct.24, 2013

Approved by:



*Jim Zhang*

Manager: Jim Zhang  
Oct.24, 2013

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: 9290002841

### Photometric and Electrical Measurements for two lamps

Voltage (V AC)	Current (A)	Power (W)	Power Factor	Total Luminous Flux (lm)	Luminous Efficacy (lm/W)	Total Harmonic Distortion
120.0	0.291	34.8	0.9964	3211	92.3	6.22

### Photometric and Colorimetric Measurements for each lamp

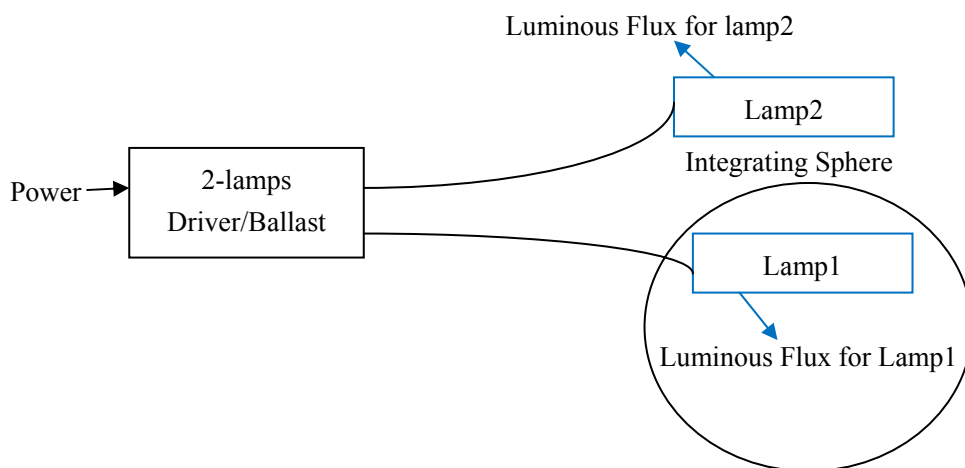
Sample Number	Luminous Flux(lm)	Correlated Color Temperature (K)	Color Rendering Index Ra
S13090016-01	1606	3968	81.5
S13090016-02	1605	3961	81.6
Sample Number	Color Rendering Index R9	Chromaticity Coordinate x	Chromaticity Coordinate y
S13090016-01	15.5	0.3820	0.3785
S13090016-02	16.2	0.3822	0.3782

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** : Sep.23, 2013

**Date of Test** : Sep.23, 2013

**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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## Sample Photos



Figure 1- Overview of the sample

### Equipment Under Test (EUT)

<b>Name</b>	: InstantFit LEDtube
<b>Model</b>	: 9290002841
<b>Electrical Ratings</b>	: 120V AC, 60Hz, 17.5W
<b>Product Description</b>	: G13 base, 4000K
<b>Manufacturer</b>	: Philips (China) Investment Co., Ltd.
<b>Address</b>	: Building 9, Lane 888, Tianlin Road Shanghai, China

## TEST RESULTS

Test ambient temperature was 24.5°C

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

The stabilization time of the sample was 70 minutes, and the total operating time including stabilization was 105 minutes.

### Sphere-Spectroradiometer Method

Parameter	Result		Special Color Rendering Indices		
	1#	2#		1#	2#
Test Voltage (V)	120.0				
Voltage frequency (Hz)	60		R1	79.7	79.9
Test Current (A)	0.291		R2	86.3	86.6
Power Factor	0.9964		R3	90.7	90.9
Test Power (W)	34.8		R4	80.5	80.6
Luminous Efficacy (lm/W)	92.3		R5	79.1	79.3
THD A%	6.22		R6	80	80.3
Total Luminous Flux (lm)	1606	1605	R7	87.4	87.4
Color Rendering Index (CRI)	81.5	81.6	R8	68	68.1
R9	15.5	16.2	R9	15.5	16.2
Correlated Color Temperature (CCT) (K)	3968	3961	R10	66.9	67.4
Chromaticity (Chroma x, Chroma y)	(0.3820, 0.3785)	(0.3822, 0.3782)	R11	77.8	77.8
Chromaticity (Chroma u, Chroma v)	(0.2254, 0.3350)	(0.2257, 0.3350)	R12	55.6	55.7
Chromaticity (Chroma u', Chroma v')	(0.2254, 0.5026)	(0.2257, 0.5025)	R13	80.9	81.2
Duv	0.0003	0.0001	R14	94.7	94.8

Table 2: Test data per Sphere-Spectroradiometer Method

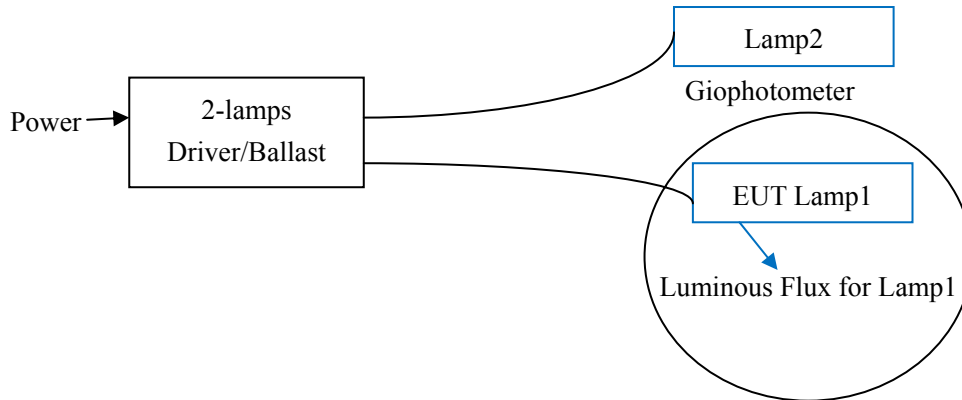
Note: According to CIE 1976 (u',v') diagram,  $u' = u = 4x/(-2x+12y+3)$ ,  $v' = 3v/2 = 9y/(-2x+12y+3)$ .

### Goniophotometer Method

The photometric distance is 2.475m.

Luminous data was taken at  $0.5^\circ$  vertical intervals and  $5^\circ$  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)	0.146
Power Factor	0.9972
Test Power (W)	17.5
Luminous Efficacy (lm/W)	92.6
Total Luminous Flux (lm)	1620.3
Beam Angle ( $^\circ$ )	140.7
Center Beam Candle Power (cd)	361
Maximum Beam Candle Power (cd)	360.7 (At: C=170.0, Gamma=1.0)
Spacing Criteria	1.29 ( $0^\circ$ - $180^\circ$ )/ 1.38( $90^\circ$ - $270^\circ$ )
Zonal Lumens in the $0^\circ$ - $60^\circ$ Zone	56.00%
Zonal Lumens in the $60^\circ$ - $90^\circ$ Zone	29.43%
Zonal Lumens in the $90^\circ$ - $120^\circ$ Zone	11.92%
Zonal Lumens in the $120^\circ$ - $180^\circ$ Zone	2.65%

Table 3: Test data per Goniophotometer Method

## Spectral Power Distribution of 2# tube - Sphere Spectroradiometer Method

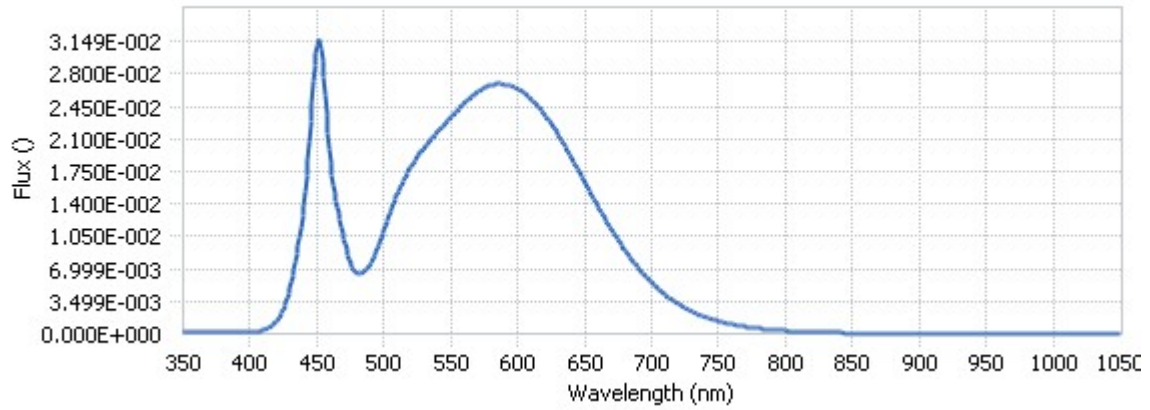


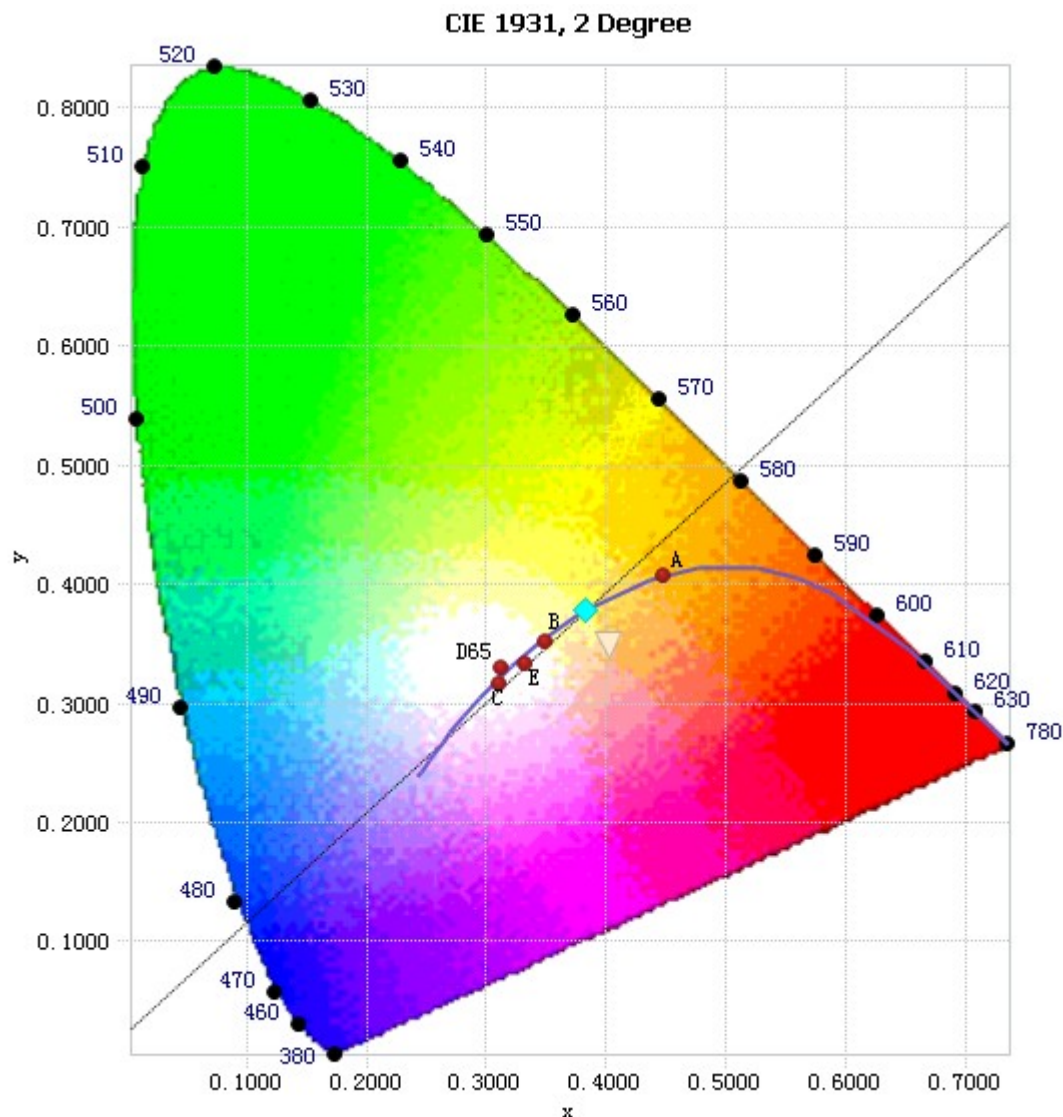
Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.45E-04	485	6.68E-03	590	2.69E-02	695	6.25E-03
385	1.45E-04	490	7.59E-03	595	2.68E-02	700	5.50E-03
390	1.48E-04	495	9.21E-03	600	2.64E-02	705	4.81E-03
395	1.41E-04	500	1.12E-02	605	2.59E-02	710	4.22E-03
400	1.82E-04	505	1.32E-02	610	2.53E-02	715	3.70E-03
405	2.49E-04	510	1.51E-02	615	2.45E-02	720	3.22E-03
410	3.89E-04	515	1.67E-02	620	2.36E-02	725	2.80E-03
415	7.28E-04	520	1.80E-02	625	2.26E-02	730	2.43E-03
420	1.38E-03	525	1.91E-02	630	2.15E-02	735	2.11E-03
425	2.66E-03	530	2.00E-02	635	2.03E-02	740	1.82E-03
430	4.94E-03	535	2.09E-02	640	1.90E-02	745	1.57E-03
435	8.59E-03	540	2.17E-02	645	1.76E-02	750	1.36E-03
440	1.39E-02	545	2.25E-02	650	1.63E-02	755	1.18E-03
445	2.30E-02	550	2.33E-02	655	1.50E-02	760	1.02E-03
450	3.11E-02	555	2.40E-02	660	1.37E-02	765	8.74E-04
455	2.77E-02	560	2.47E-02	665	1.24E-02	770	7.59E-04
460	1.83E-02	565	2.54E-02	670	1.12E-02	775	6.57E-04
465	1.36E-02	570	2.61E-02	675	1.01E-02	780	5.74E-04
470	1.02E-02	575	2.65E-02	680	9.01E-03		
475	7.50E-03	580	2.68E-02	685	8.02E-03		
480	6.51E-03	585	2.70E-02	690	7.10E-03		

Table 3: Spectral Power Distribution Numerical Data per Sphere - Spectroradiometer Method



## Chromaticity Diagram of 2# tube - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3822, 0.3782)

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 2# tube – Sphere Spectroradiometer Method

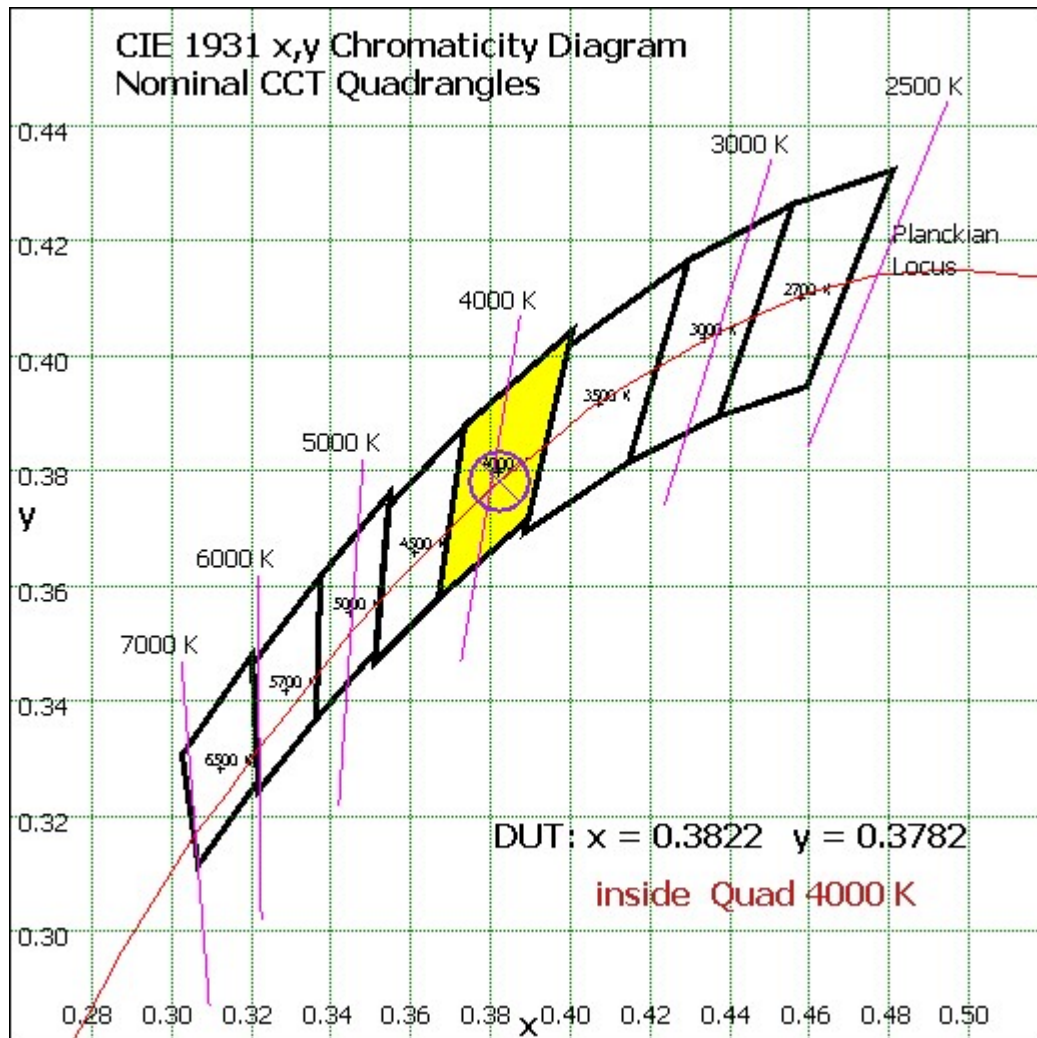


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

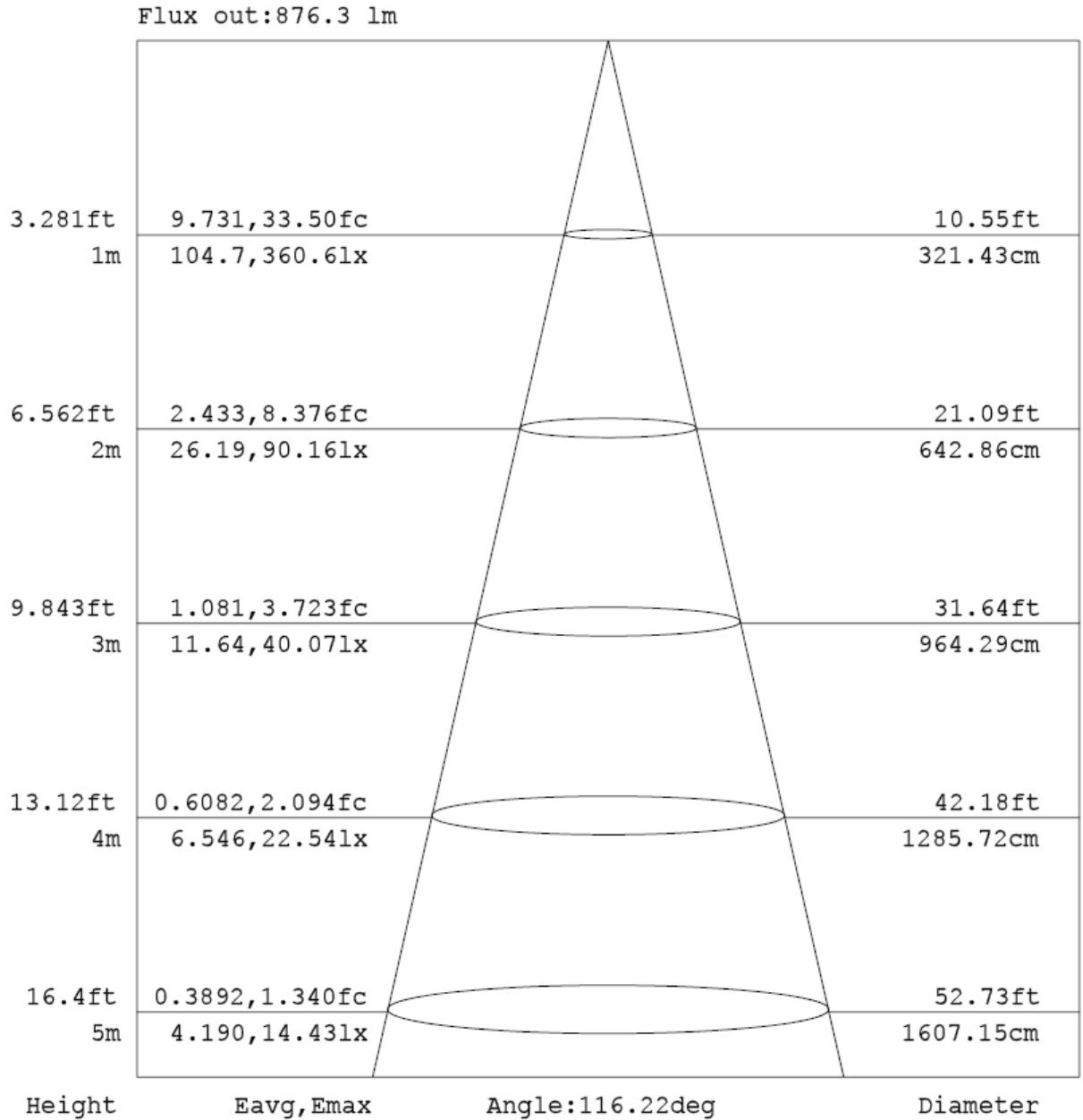
### Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	34.217	2.11%
10- 20	99.175	6.12%
20- 30	154.084	9.51%
30- 40	193.428	11.94%
40- 50	213.501	13.18%
50- 60	212.986	13.15%
60- 70	193.617	11.95%
70- 80	160.538	9.91%
80- 90	122.642	7.57%
90-100	89.873	5.55%
100-110	62.845	3.88%
110-120	40.358	2.49%
120-130	23.667	1.46%
130-140	12.323	0.76%
140-150	5.096	0.31%
150-160	1.501	0.09%
160-170	0.309	0.02%
170-180	0.053	0.00%
Total	1620.2	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	907.391	56.00%
60- 90	476.797	29.43%
0-90	1384.188	85.43%
90- 180	236.025	14.57%
0- 180	1620.2	100%

Table 4: Zonal Lumen Data

## Illuminance Plots- Goniophotometer Method



**Note:** The Curves indicate the illuminated area and the average illumination when the luminaire is at different distance.

Chart 4: Beam Angle

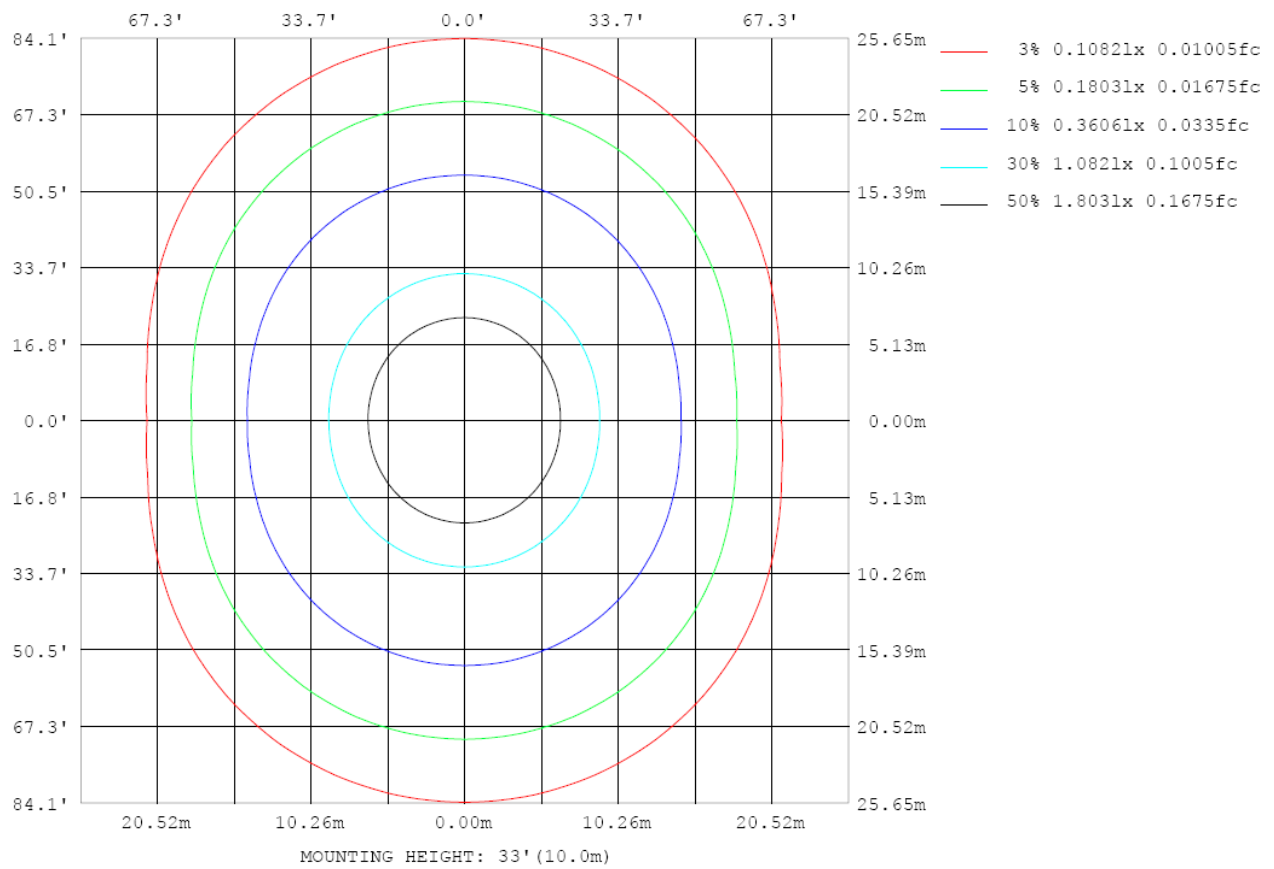


Chart 5: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

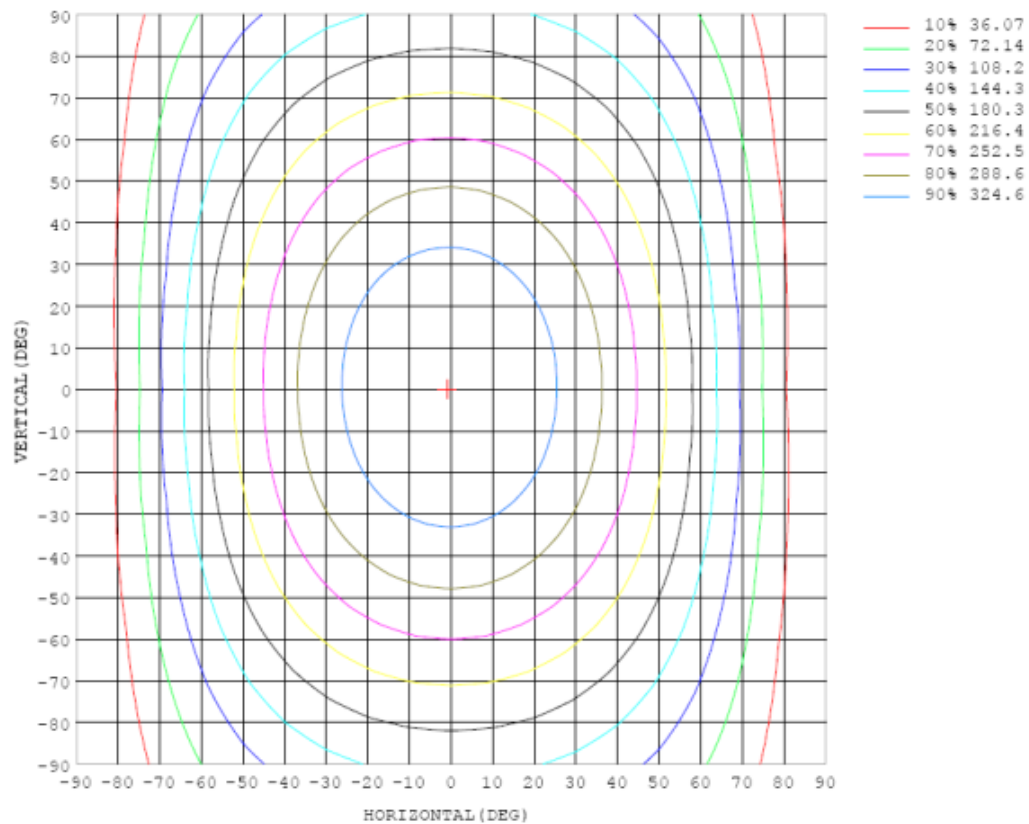


Chart 6: Isocandela Plot

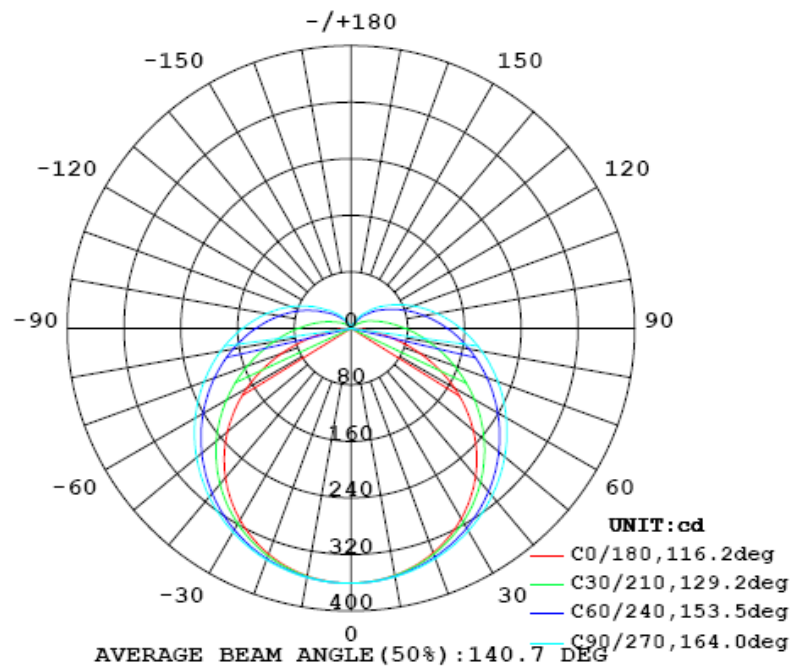


Chart 7: Polar Candela Distribution

## 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	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361
5	359	359	359	359	359	359	359	359	359	360	360	360	360	360	360	359	359	359	360
10	355	355	355	355	355	356	356	356	357	357	357	357	357	357	356	356	356	356	356
15	348	348	348	349	350	350	351	352	352	353	353	352	352	351	351	350	349	349	349
20	338	338	339	340	342	343	345	346	347	347	347	346	345	344	343	341	340	340	340
25	326	326	327	329	332	334	336	338	339	340	339	338	337	335	333	331	329	328	328
30	311	311	313	316	320	323	326	329	330	331	330	329	327	324	321	318	315	314	313
35	293	294	297	301	306	310	314	318	320	321	320	318	315	311	307	303	299	296	296
40	273	275	278	284	290	296	302	306	308	309	308	306	302	297	292	286	280	276	276
45	250	252	258	265	273	281	287	292	295	297	296	293	288	282	274	267	259	254	253
50	225	228	235	245	255	264	272	278	282	283	282	278	272	265	256	246	237	230	228
55	198	202	211	223	235	247	256	263	267	268	267	263	256	247	236	224	212	203	200
60	168	173	186	201	215	228	239	246	251	253	251	247	239	228	215	201	186	174	170
65	136	144	160	178	195	209	221	230	235	237	235	230	221	209	194	177	159	144	138
70	104	114	134	155	174	191	204	213	219	220	218	213	203	190	173	154	132	113	104
75	70.7	84.2	108	133	155	172	186	196	202	204	202	196	186	171	153	130	105	82.1	70.7
80	39.5	56.9	84.9	112	136	155	169	179	185	187	185	179	168	153	133	109	81.0	53.6	39.1
85	14.2	34.7	64.7	93.3	118	137	152	163	169	171	168	162	151	135	115	89.4	60.0	30.2	12.8
90	1.00	19.7	48.4	76.4	101	121	136	147	153	155	152	146	134	118	97.7	72.3	43.4	15.3	0.33
95	0.38	11.0	35.7	62.0	85.5	105	120	131	137	139	136	130	119	103	82.3	57.9	31.2	7.69	0.01
100	0.13	6.23	26.1	49.6	71.7	90.3	105	115	121	123	121	114	103	88.0	68.6	45.9	22.5	4.59	0.00
105	0.00	3.45	19.7	39.1	59.1	76.5	90.5	100	106	108	106	99.4	89.0	74.5	56.4	36.1	16.6	3.19	0.00
110	0.03	1.81	13.5	31.2	48.1	63.8	76.7	86.1	91.6	93.3	91.2	85.2	75.5	62.1	45.9	28.7	12.3	2.26	0.00
115	0.06	1.01	8.29	24.5	39.3	52.6	64.2	72.7	77.9	79.4	77.5	72.0	63.1	51.2	37.5	22.4	9.00	1.62	0.01
120	0.14	0.74	5.20	17.5	31.9	43.6	53.0	60.5	65.2	66.6	64.8	59.9	52.1	42.3	29.8	17.2	6.69	1.11	0.02
125	0.22	0.62	3.06	12.3	24.8	35.2	44.3	50.3	54.0	55.1	53.7	49.7	43.2	33.6	23.2	13.0	4.55	0.87	0.15
130	0.30	0.56	2.24	7.20	17.6	27.2	34.5	40.9	44.6	45.6	44.2	40.1	33.6	26.2	17.9	9.22	3.29	0.78	0.24
135	0.36	0.49	1.54	4.44	11.0	20.2	27.0	30.7	33.7	34.8	33.5	30.6	26.3	20.1	12.6	6.26	2.27	0.51	0.32
140	0.41	0.46	1.21	3.21	6.47	12.4	18.9	24.0	26.5	27.2	26.3	23.7	19.2	13.7	8.29	4.28	1.73	0.50	0.35
145	0.44	0.53	0.93	2.10	4.29	7.32	11.5	15.2	17.5	18.4	17.7	15.6	12.3	8.75	5.49	2.86	1.22	0.52	0.40
150	0.46	0.51	0.71	1.56	2.72	4.30	6.70	9.01	10.4	11.0	10.6	9.45	7.67	5.50	3.47	2.06	0.87	0.49	0.39
155	0.46	0.48	0.62	1.07	1.90	2.71	3.60	4.88	6.01	6.34	6.16	5.46	4.40	3.27	2.31	1.26	0.68	0.49	0.42
160	0.47	0.48	0.50	0.72	1.14	1.71	2.13	2.50	2.93	3.27	3.23	2.90	2.44	1.90	1.26	0.81	0.61	0.48	0.45
165	0.49	0.47	0.48	0.53	0.68	0.92	1.20	1.40	1.55	1.62	1.61	1.47	1.26	1.00	0.79	0.66	0.54	0.48	0.46
170	0.52	0.50	0.48	0.48	0.52	0.59	0.65	0.70	0.75	0.78	0.78	0.75	0.70	0.65	0.61	0.55	0.50	0.47	0.47
175	0.51	0.50	0.48	0.47	0.48	0.50	0.53	0.54	0.54	0.54	0.54	0.54	0.53	0.53	0.53	0.51	0.49	0.47	0.47
180	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50

Table 5: 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	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361	361		
5	360	360	360	360	360	360	360	360	360	360	360	360	359	359	359	359	359		
10	356	356	357	357	357	357	358	358	358	358	357	357	356	356	356	355	355		
15	349	350	351	352	352	353	354	354	354	354	353	352	351	350	349	349	348		
20	340	341	343	344	346	347	348	349	349	348	347	346	344	343	341	340	339		
25	329	330	332	335	337	339	340	341	342	341	339	338	335	333	330	328	326		
30	314	316	319	323	326	329	331	333	333	332	330	327	324	321	317	314	312		
35	297	300	305	309	314	318	321	322	323	322	319	316	311	307	302	298	294		
40	278	282	288	294	300	305	308	311	311	310	307	303	297	291	284	279	275		
45	256	261	269	277	284	290	295	298	298	297	293	288	281	273	265	258	252		
50	231	238	248	258	267	275	280	284	284	283	279	272	264	255	244	235	228		
55	204	214	226	238	249	258	265	269	270	268	263	256	246	235	222	210	201		
60	175	188	203	218	231	241	248	253	254	252	246	238	227	214	199	184	172		
65	145	161	179	197	211	223	231	236	237	235	229	220	208	193	175	157	142		
70	114	134	156	176	192	205	214	219	221	218	212	202	189	172	152	130	111		
75	83.5	108	133	155	173	187	197	202	204	201	195	184	170	151	129	104	79.9		
80	55.7	83.8	111	135	154	169	179	185	187	184	178	167	151	131	107	79.4	52.1		
85	33.0	63.5	91.7	116	136	152	162	168	170	167	160	149	133	113	87.8	59.3	29.4		
90	17.8	46.5	74.4	99.0	119	134	145	151	153	151	144	132	116	95.9	70.6	42.8	14.8		
95	9.61	33.7	60.1	83.4	103	118	129	135	137	134	128	116	101	80.7	57.0	30.6	7.50		
100	5.25	23.8	47.4	69.3	88.2	103	113	119	121	119	112	101	86.2	67.9	44.8	21.2	3.94		
105	2.45	16.3	36.3	56.8	74.1	88.1	98.0	104	106	103	97.2	86.7	72.4	54.6	33.2	13.8	2.50		
110	1.69	11.9	27.1	44.3	61.0	73.8	83.2	88.8	90.6	88.5	82.4	72.6	59.6	41.9	24.5	10.4	1.53		
115	1.14	8.44	20.4	34.6	48.2	59.8	68.6	74.0	75.8	73.7	67.9	58.3	46.7	32.7	19.5	7.56	1.19		
120	1.01	6.43	16.0	27.1	37.4	47.2	55.2	60.3	61.8	59.7	53.9	46.7	36.5	26.3	14.8	5.56	1.15		
125	0.74	4.46	11.5	20.8	30.4	38.2	42.9	46.7	47.7	45.3	41.8	37.5	29.7	19.9	10.9	4.13	0.91		
130	0.56	3.08	8.65	16.1	23.6	29.9	35.1	38.5	39.7	38.4	35.0	29.5	22.8	14.9	8.28	3.19	0.73		
135	0.48	2.18	6.18	11.5	17.8	23.1	27.3	29.9	30.9	30.0	27.1	22.4	16.9	11.0	5.99	2.43	0.63		
140	0.45	1.53	4.38	8.13	12.6	17.0	20.1	22.4	23.1	22.1	19.7	16.4	12.1	8.25	4.29	1.81	0.56		
145	0.42	1.07	2.96	5.59	8.75	11.8	14.4	16.1	16.5	15.9	14.3	11.7	8.62	5.59	3.01	1.37	0.52		
150	0.39	0.65	1.85	3.68	5.68	7.77	9.59	10.8	11.2	10.8	9.68	7.98	5.53	3.51	1.97	1.01	0.50		
155	0.39	0.47	1.03	2.27	3.57	4.79	5.78	6.64	6.97	6.77	5.92	4.20	3.11	2.12	1.35	0.73	0.50		
160	0.38	0.43	0.51	1.04	1.90	2.59	3.30	3.88	4.06	3.74	2.81	2.19	1.72	1.32	0.91	0.60	0.52		
165	0.42	0.41	0.48	0.58	0.81	1.20	1.61	1.76	2.01	1.47	1.35	1.21	1.03	0.85	0.65	0.60	0.52		
170	0.47	0.49	0.50	0.52	0.61	0.72	0.79	0.88	0.79	0.86	0.83	0.75	0.66	0.65	0.60	0.55	0.52		
175	0.47	0.48	0.50	0.51	0.52	0.52	0.49	0.48	0.53	0.54	0.54	0.54	0.53	0.52	0.51	0.51	0.50		
180	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50		

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, 2013	Sep. 17, 2014
Digital Power Meter	PF2010A	HZTE028-01	Sep. 18, 2013	Sep. 17, 2014
AC Power Supply	PCR 500L	HZTE001-08	Sep. 18, 2013	Sep. 17, 2014
DC Power Supply	WY12010	HZTE004-03	Sep. 18, 2013	Sep. 17, 2014
Temperature Meter	TES1310	HZTE017-01	Sep. 18, 2013	Sep. 17, 2014
Standard source	D908	HZTE012-01	Sep. 18, 2013	Sep. 17, 2014
Integrate Sphere system	2M	HZTE015-01	Sep. 18, 2013	Sep. 17, 2014
Digital Power Meter	WT210	HZTE008-01	Sep. 18, 2013	Sep. 17, 2014
AC Power Supply	PCR 500L	HZTE001-07	Sep. 18, 2013	Sep. 17, 2014
DC Power Supply	6154	HZTE004-04	Sep. 18, 2013	Sep. 17, 2014
Temperature and humidity recorder	JR900	HZTE018-01	Sep. 18, 2013	Sep. 17, 2014
Standard source	SCL-1400	HZTE012-02	Sep. 18, 2013	Sep. 17, 2014

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  $4\pi$ . 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 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 expended uncertainty is 1.94% with a coverage factor  $k=2$ .

### **Color Characteristics Measurements**

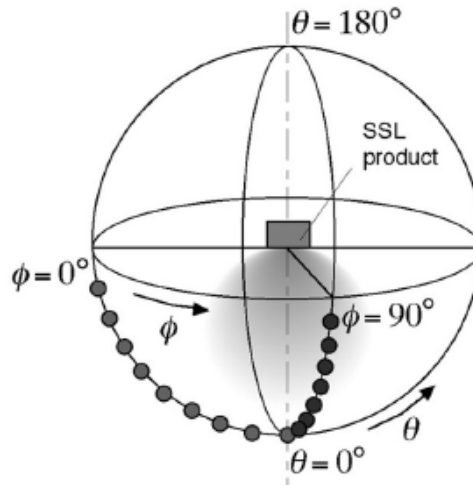
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as 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  $10^\circ$  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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