



## LM-79-08 Test Report

for

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

Building 9, Lane 888, Tianlin Road  
Shanghai, China

**InstantFit LEDtube**

**Model: 9290011196(2 lamps+ballast ICN-2P32-N)**

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Report No.: HZ14060013i

Review by:

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Jul. 01, 2014

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*Jim Zhang*

Manager: Jim Zhang  
Jul. 01, 2014

## Test Summary

Sample Tested: 9290011196(2 lamps+ballast ICN-2P32-N)

### 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	0.319	38.2	0.9976	3833.0	100.3	5.59

### Photometric and Colorimetric Measurements for each lamp

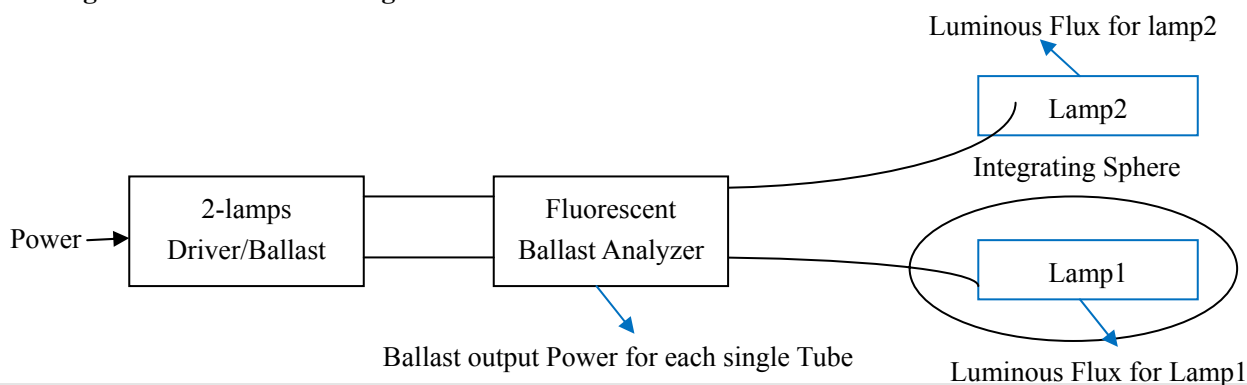
Sample Number	Luminous Flux(lm)	Test power (W)(bare tube)	Efficiency for single Tube (lm/W)	Correlated Color Temperature (K)
1#	1909.0	15.1	126.4	2997
2#	1924.0	15.0	128.3	3009
Sample Number	Color Rendering Index Ra	Color Rendering Index R9	Chromaticity Coordinate x	Chromaticity Coordinate y
1#	81.4	15.1	0.4367	0.4034
2#	81.4	15.1	0.4355	0.4025

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** : Jun. 17, 2014

**Date of Test** : Jun. 27, 2014

**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

The Ballast output Power for single Tube was tested using the Fluorescent Ballast Analyzer as per Client's requirement.

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## Sample Photos

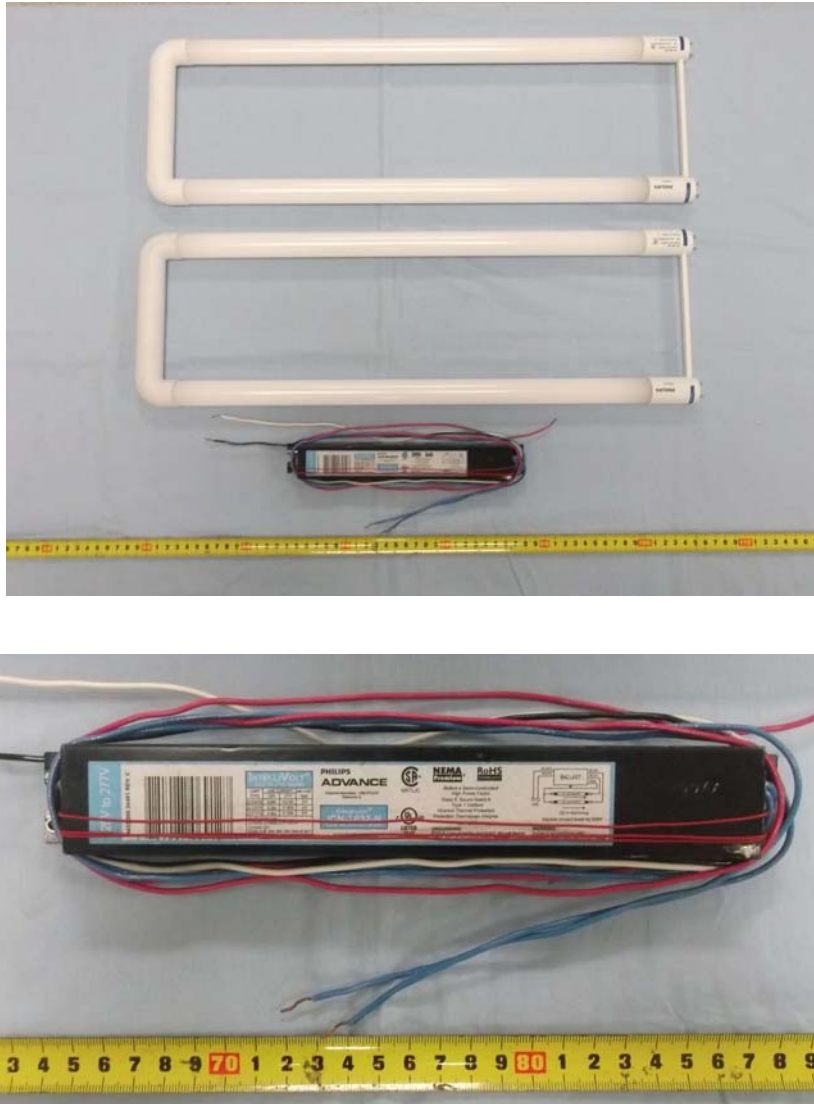


Figure 1- Overview of the sample

### Equipment Under Test (EUT)

<b>Name</b>	: InstantFit LEDtube
<b>Model</b>	: 9290011196(2 lamps+ballast ICN-2P32-N)
<b>Electrical Ratings</b>	: 120V AC, 60Hz, 16.5W
<b>Product Description</b>	: 16.5T8/24-3000 IF-6U 10/1, G13 base, 3000K, U bent tube LED tubes supplied by a high frequency fluorescent lamp ballast: PHILIPS ICN-2P32-N
<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 24.8°C

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

The stabilization time of the sample was 60 minutes, and the total operating time including stabilization was 70 minutes.

### Sphere-Spectroradiometer Method

Parameter	Result		Special Color Rendering Indices		
	1#	2#			
Test Voltage (V)	120.0			1#	2#
Voltage frequency (Hz)	60		R1	79.4	79.3
Test Current (A)	0.319		R2	88.1	88
Power Factor	0.9976		R3	95	94.7
Test power (W) (ballast + 2 tubes)	38.2		R4	78.8	78.8
Luminous Efficacy (lm/W)	100.3		R5	78.5	78.4
THD A%	5.59		R6	83.4	83.2
Total Luminous Flux (lm)	1909.0	1924.0	R7	85.2	85.1
Test power (W) (bare tube)	15.1	15.0	R8	63.2	63.2
Efficiency for single Tube (lm/W)	126.4	128.3	R9	15.1	15.1
Color Rendering Index (CRI)	81.4	81.4	R10	72	71.6
R9	15.1	15.1	R11	75.8	75.8
Correlated Color Temperature (CCT) (K)	2997	3009	R12	63.5	63.4
Chromaticity (Chroma x, Chroma y)	(0.4367, 0.4034)	(0.4355, 0.4025)	R13	81	80.9
Chromaticity (Chroma u, Chroma v)	(0.2507, 0.3474)	(0.2504, 0.3470)	R14	97	96.8
Chromaticity (Chroma u', Chroma v')	(0.2507, 0.5211)	(0.2504, 0.5205)			
Duv	0.0004	0.0006			

Table 2: Test data per Sphere-Spectroradiometer Method

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

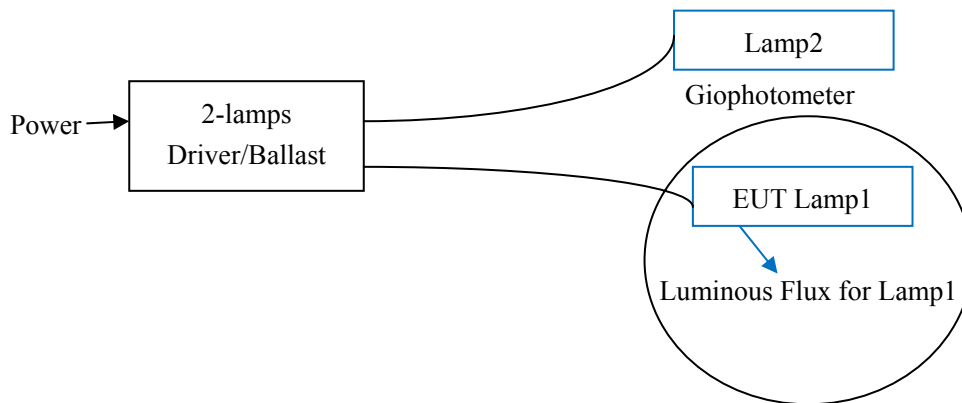
### Goniophotometer Method

Test ambient temperature was 25.3°C

The photometric distance is 2.475m.

Luminous data was taken at 0.5°vertical intervals and 5°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)	0.313
Power Factor	0.9973
Test power (W) (ballast + 2 tubes)/2	18.7
Luminous Efficacy (lm/W)	101.9
Total Luminous Flux (lm) (Single tube)	1906.0
Test power (W) (bare tube)	15.1
Luminous Efficacy (lm/W) (bare tube)	126.2
Beam Angle (°)	109.9 (0°-180°)/ 164.5 (90°-270°)
Center Beam Candle Power (cd)	457
Maximum Beam Candle Power (cd)	457.3 (At: C=320.0, Gamma=3.5)
Spacing Criteria	1.22 (0°-180°)/ 1.40(90°-270°)
Zonal Lumens in the 0°-60°Zone	59.05%
Zonal Lumens in the 60°-90°Zone	29.53%
Zonal Lumens in the 90°-120°Zone	9.24%
Zonal Lumens in the 120°-180°Zone	2.18%

Table 3: Test data per Goniophotometer Method

## Spectral Power Distribution of 1# tube - Sphere Spectroradiometer Method

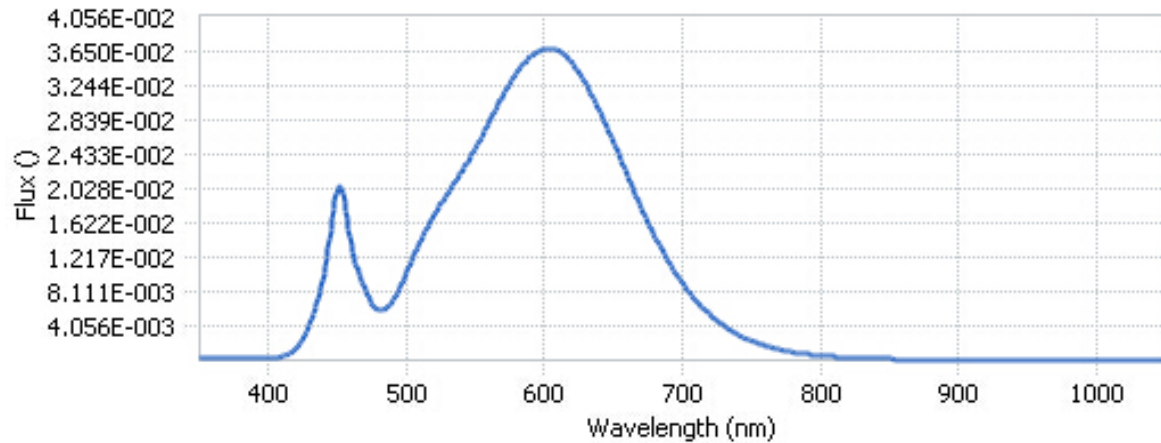
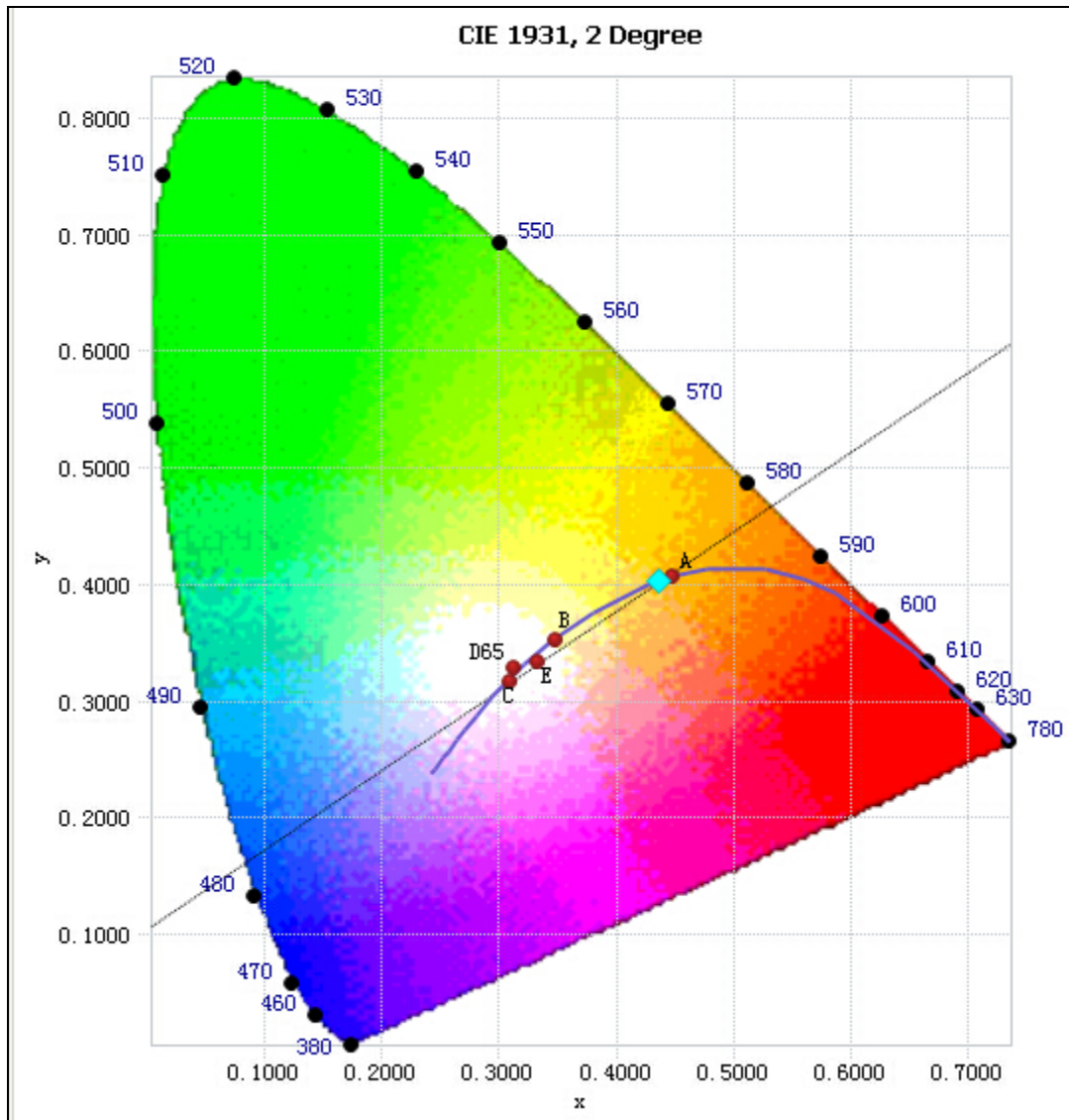


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.13E-04	485	6.16E-03	590	3.59E-02	695	1.03E-02
385	2.03E-04	490	6.98E-03	595	3.65E-02	700	9.10E-03
390	1.71E-04	495	8.44E-03	600	3.68E-02	705	8.03E-03
395	1.96E-04	500	1.03E-02	605	3.69E-02	710	7.05E-03
400	2.20E-04	505	1.23E-02	610	3.66E-02	715	6.16E-03
405	3.00E-04	510	1.41E-02	615	3.59E-02	720	5.40E-03
410	4.65E-04	515	1.56E-02	620	3.51E-02	725	4.70E-03
415	7.89E-04	520	1.72E-02	625	3.39E-02	730	4.09E-03
420	1.45E-03	525	1.86E-02	630	3.27E-02	735	3.53E-03
425	2.55E-03	530	1.97E-02	635	3.11E-02	740	3.08E-03
430	4.33E-03	535	2.10E-02	640	2.95E-02	745	2.64E-03
435	6.82E-03	540	2.23E-02	645	2.76E-02	750	2.33E-03
440	1.02E-02	545	2.36E-02	650	2.58E-02	755	2.00E-03
445	1.54E-02	550	2.51E-02	655	2.38E-02	760	1.72E-03
450	2.03E-02	555	2.65E-02	660	2.19E-02	765	1.50E-03
455	1.88E-02	560	2.83E-02	665	2.00E-02	770	1.29E-03
460	1.36E-02	565	2.97E-02	670	1.82E-02	775	1.12E-03
465	1.05E-02	570	3.14E-02	675	1.64E-02	780	9.59E-04
470	8.46E-03	575	3.28E-02	680	1.47E-02		
475	6.61E-03	580	3.41E-02	685	1.31E-02		
480	5.87E-03	585	3.51E-02	690	1.17E-02		

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

### Chromaticity Diagram of 1# tube - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4367, 0.4034)

### 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

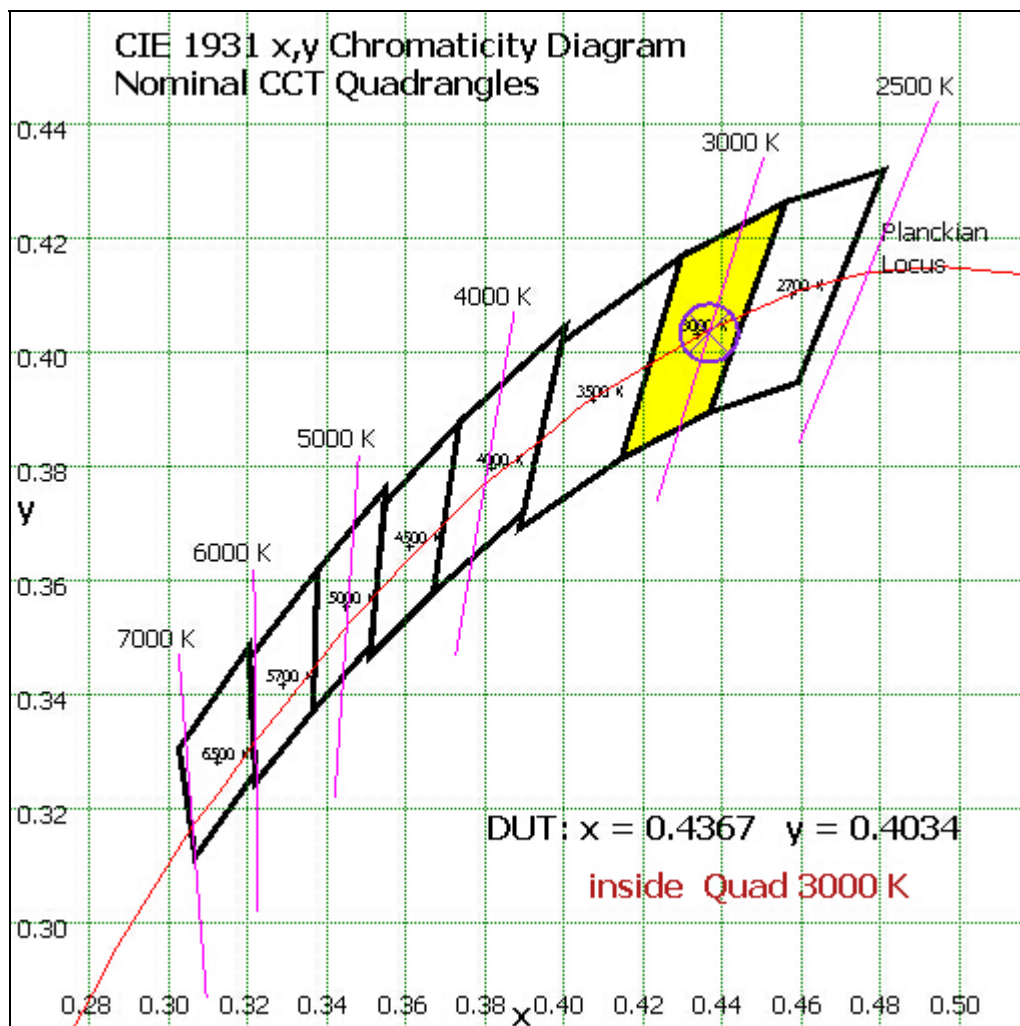


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

### Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	43.298	2.27%
10- 20	125.16	6.57%
20- 30	193.298	10.14%
30- 40	240.609	12.62%
40- 50	263.036	13.80%
50- 60	260.162	13.65%
60- 70	235.425	12.35%
70- 80	195.522	10.26%
80- 90	131.842	6.92%
90-100	74.573	3.91%
100-110	63.213	3.32%
110-120	38.266	2.01%
120-130	21.465	1.13%
130-140	10.577	0.55%
140-150	5.367	0.28%
150-160	2.643	0.14%
160-170	1.292	0.07%
170-180	0.28	0.01%
Total	1906.0	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1125.563	59.05%
60- 90	562.789	29.53%
0-90	1688.352	88.58%
90- 180	217.676	11.42%
0- 180	1906.0	100%

Table 5: Zonal Lumen Data

## Illuminance Plots- Goniophotometer Method

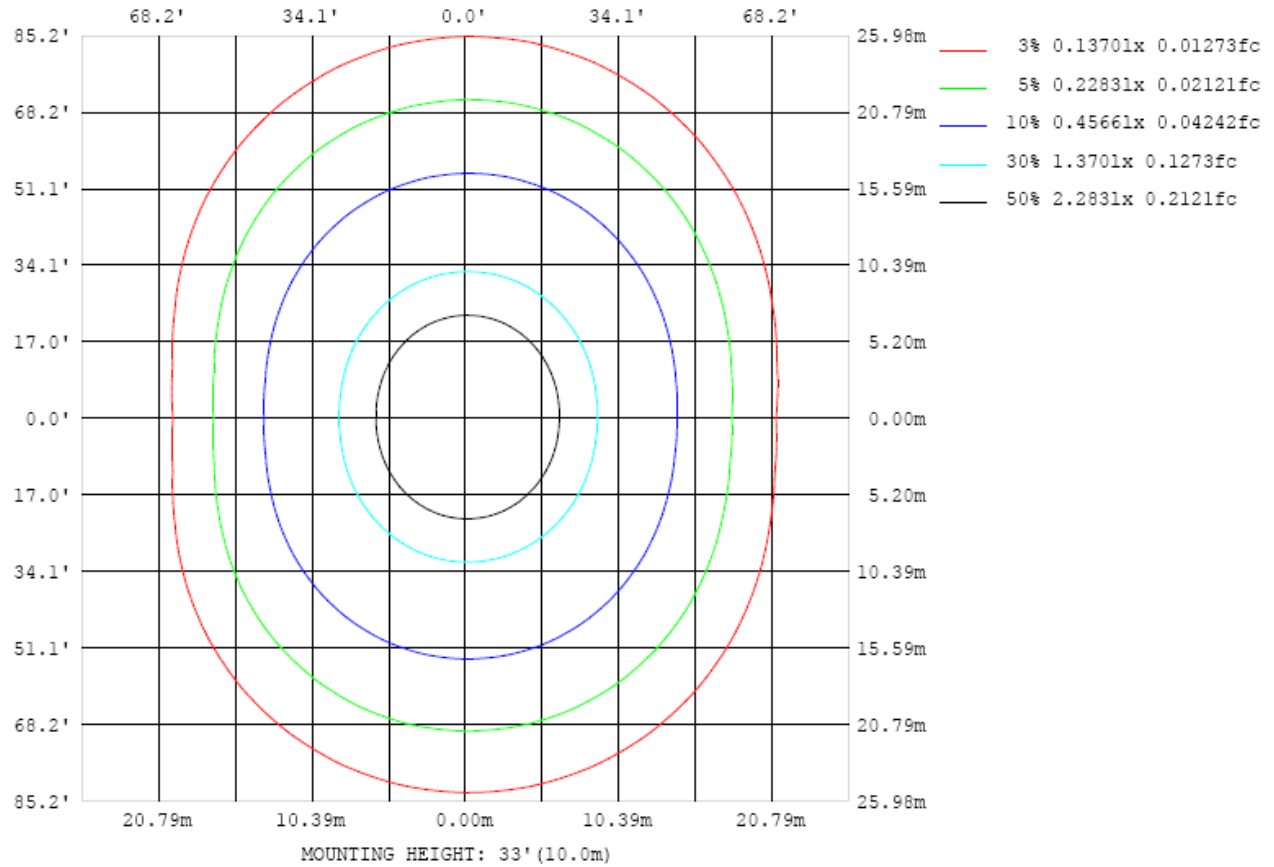


Chart 4: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

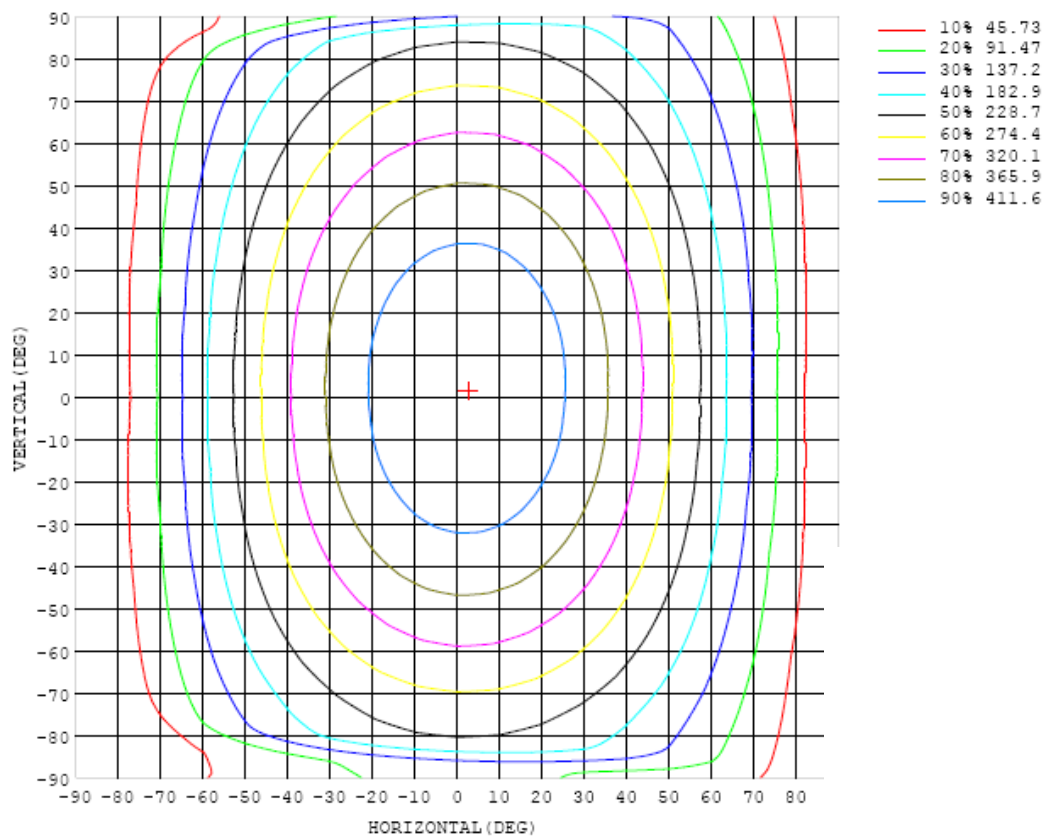


Chart 5: Isocandela Plot

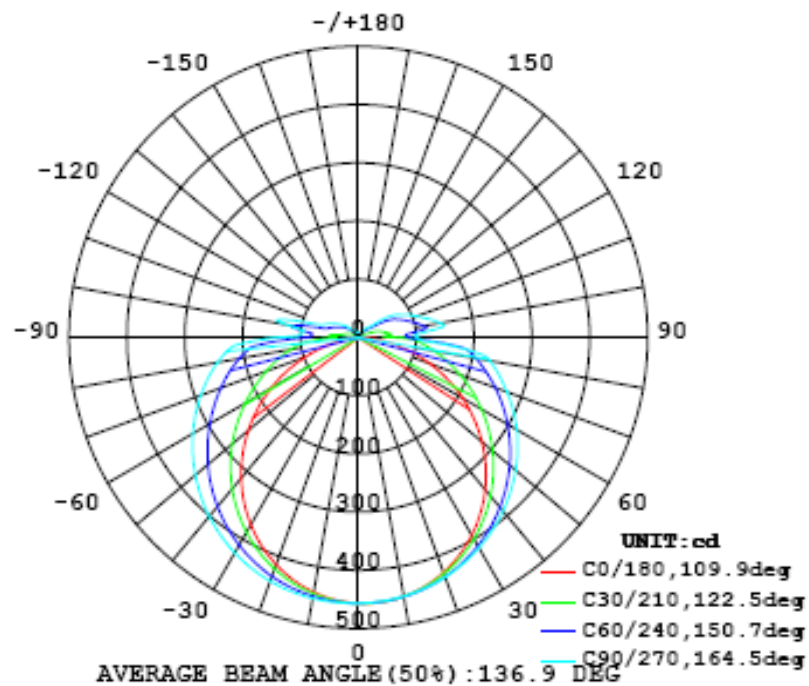


Chart 6: Polar Candela Distribution

## 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	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457
5	456	456	456	456	456	456	456	455	455	455	455	454	454	453	453	453	452	452	453
10	452	451	451	452	452	452	452	452	452	451	451	450	449	447	446	445	444	444	444
15	443	443	443	444	445	445	446	447	447	446	445	443	441	439	436	434	433	432	432
20	430	430	431	432	434	436	438	439	439	438	437	434	431	427	424	420	417	415	415
25	413	413	415	417	420	424	427	429	429	429	427	423	419	413	408	403	398	396	395
30	392	393	395	399	404	409	413	416	418	417	415	410	404	397	390	382	376	372	372
35	368	369	373	379	385	392	398	402	404	404	401	395	388	379	369	360	352	346	345
40	341	342	348	355	364	373	381	386	389	389	386	379	370	359	347	335	324	317	315
45	311	313	320	330	341	352	362	369	373	373	369	361	351	338	323	308	295	286	283
50	279	282	290	303	317	330	341	350	354	355	351	342	330	315	298	281	264	252	248
55	244	248	259	275	291	307	320	330	335	336	332	322	309	292	272	252	232	218	212
60	208	213	227	246	265	283	298	309	315	316	311	301	287	268	247	223	200	182	174
65	170	177	194	216	238	258	275	287	294	295	290	280	265	245	221	195	168	145	136
70	132	140	162	187	212	234	252	265	272	273	269	258	242	221	196	167	137	110	97.0
75	93.5	105	130	159	187	210	229	242	250	252	248	237	220	198	171	141	108	76.7	60.1
80	57.9	71.5	102	133	162	187	206	221	229	231	226	215	198	176	148	116	81.9	48.5	27.9
85	26.6	43.7	76.0	109	139	162	169	169	165	158	149	136	122	106	88.2	68.9	47.6	22.0	5.53
90	6.48	22.7	49.7	64.0	71.9	77.9	86.9	95.0	100	102	99.6	93.9	84.7	73.7	58.6	44.1	28.5	9.21	1.30
95	1.63	10.5	33.7	55.1	68.8	81.7	93.1	104	113	119	123	123	119	104	78.6	52.5	28.3	8.67	1.29
100	1.28	3.96	25.9	49.2	73.3	95.6	114	130	140	144	140	131	115	94.6	70.7	46.5	23.5	4.26	1.58
105	1.56	3.08	16.2	40.2	62.9	82.9	99.7	113	122	125	122	113	99.7	82.5	61.8	39.5	15.3	3.45	1.94
110	1.82	2.91	8.97	29.8	52.8	71.7	86.5	97.9	105	107	105	97.6	86.0	71.1	52.3	29.2	9.22	3.12	2.27
115	1.91	2.74	7.04	15.8	39.1	60.3	74.2	84.2	90.5	92.6	90.4	84.1	73.5	59.6	38.7	15.8	7.35	2.86	2.49
120	2.21	2.51	5.88	12.5	21.6	42.0	60.1	70.7	76.8	78.9	76.9	70.4	59.6	41.6	21.3	12.9	6.02	2.70	2.66
125	2.39	2.26	4.84	9.76	16.8	24.0	37.1	50.8	58.5	61.2	58.7	50.6	37.1	24.1	17.3	10.2	5.16	2.62	2.84
130	2.69	2.18	4.13	8.04	13.2	19.2	24.3	29.1	34.3	36.3	34.2	29.0	24.6	19.6	13.5	8.17	4.55	2.56	3.05
135	2.92	2.14	3.65	6.25	10.3	14.8	19.4	22.8	25.0	25.7	25.1	23.0	19.7	15.2	10.5	6.69	4.02	2.47	3.27
140	3.14	2.10	3.26	5.23	8.18	11.4	14.6	17.5	19.4	20.1	19.5	17.7	14.8	11.6	8.51	5.70	3.61	2.39	3.48
145	3.36	2.14	2.94	4.40	6.32	8.79	11.1	13.0	14.3	14.8	14.4	13.1	11.3	9.14	6.76	4.80	3.23	2.38	3.65
150	3.54	2.24	2.77	3.78	5.09	6.63	8.04	9.72	10.6	11.0	10.7	9.87	8.40	7.00	5.52	4.05	2.94	2.40	3.81
155	3.71	2.34	2.62	3.29	4.23	5.18	6.15	7.02	7.56	7.81	7.64	7.18	6.44	5.52	4.47	3.49	2.72	2.42	3.89
160	3.47	2.48	2.38	2.83	3.50	4.13	4.76	5.25	5.63	5.78	5.65	5.37	4.92	4.30	3.63	2.94	2.52	2.46	3.78
165	3.09	2.84	2.33	2.56	2.87	3.31	3.72	4.03	4.24	4.28	4.22	4.04	3.71	3.26	2.85	2.52	2.31	2.66	3.44
170	2.57	2.57	2.20	2.39	2.58	2.72	2.85	2.99	3.12	3.16	3.05	2.79	2.68	2.56	2.28	2.12	2.18	2.92	3.00
175	2.58	2.58	2.54	2.50	2.33	2.39	2.31	2.36	2.41	2.40	2.40	2.35	2.04	1.96	2.05	2.32	2.74	2.70	2.73
180	3.04	2.99	2.92	2.82	2.67	2.60	2.54	2.04	1.76	1.51	1.86	1.85	2.50	2.62	2.72	2.79	2.85	2.92	3.03

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	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457	457		
5	453	453	454	454	455	455	456	456	457	457	457	457	457	457	457	457	456		
10	445	446	447	448	450	452	453	454	455	455	456	455	455	454	454	453	452		
15	433	434	437	440	442	445	448	450	451	452	452	451	450	448	446	445	444		
20	417	419	423	428	432	437	441	444	445	446	446	444	442	439	436	433	431		
25	397	401	406	413	419	426	431	435	437	438	437	435	431	427	422	418	415		
30	374	379	387	395	404	412	419	424	427	428	426	423	418	412	405	399	395		
35	348	354	364	375	386	396	405	412	415	416	413	409	402	394	385	378	372		
40	319	327	339	353	366	379	389	397	401	402	398	392	384	373	363	353	345		
45	287	298	313	329	345	360	372	381	385	385	381	374	363	351	338	326	316		
50	254	267	284	304	322	339	353	363	368	368	363	354	342	327	311	297	285		
55	218	234	255	278	299	318	333	344	350	349	344	333	319	302	283	266	252		
60	182	201	226	251	275	296	313	325	330	330	323	312	295	276	254	234	217		
65	146	169	197	225	252	275	292	305	310	310	303	290	271	249	225	201	181		
70	109	137	169	200	229	253	272	284	290	289	281	267	248	224	196	169	146		
75	75.2	108	144	177	206	231	250	263	269	268	260	245	224	199	169	139	110		
80	45.8	81.5	119	154	184	209	228	241	247	246	237	222	201	174	144	110	76.9		
85	21.6	54.8	91.3	126	157	184	204	218	224	222	214	200	178	152	120	84.3	48.7		
90	5.77	20.8	38.9	56.8	73.1	88.9	108	125	137	144	146	143	134	120	96.1	62.1	27.4		
95	6.47	19.9	49.3	68.2	74.6	79.9	88.4	94.5	97.0	95.9	90.9	82.4	71.7	58.4	42.4	27.3	11.5		
100	5.27	15.6	28.6	49.2	87.2	115	131	129	125	118	110	101	91.0	70.5	35.8	19.4	8.45		
105	4.88	13.3	23.7	35.4	47.4	62.1	85.4	104	113	110	97.2	75.7	53.5	39.0	25.6	15.4	6.00		
110	4.68	10.5	20.2	29.8	40.3	50.3	58.3	63.5	65.7	64.7	60.5	53.5	43.8	32.3	20.6	11.7	5.02		
115	4.41	8.92	16.3	25.1	34.1	42.9	50.0	54.6	56.5	55.6	51.8	45.4	36.7	26.7	16.5	8.84	4.47		
120	4.88	7.55	12.6	20.6	28.5	36.2	42.4	46.5	48.1	47.2	43.7	38.1	30.5	21.8	12.7	7.30	4.12		
125	4.71	6.51	10.0	16.0	23.3	30.1	35.4	38.9	40.3	39.4	36.4	31.5	25.0	17.2	9.75	6.10	4.59		
130	4.58	5.72	8.39	12.5	18.1	24.2	28.9	31.9	33.1	32.3	29.7	25.4	19.5	12.9	7.97	5.21	4.14		
135	4.47	5.44	7.05	9.57	13.9	18.3	22.5	25.2	26.2	25.5	23.2	19.4	14.5	10.2	6.61	4.60	3.91		
140	4.34	5.00	6.96	9.98	14.0	18.7	22.6	25.4	26.2	25.5	23.2	19.4	14.5	10.2	6.61	4.60	3.91		
145	4.29	5.09	7.40	10.48	14.6	19.0	23.1	26.0	26.8	26.1	23.8	19.9	15.0	10.5	7.00	4.77	3.69		
150	4.22	5.40	7.78	10.98	14.64	19.07	23.13	26.06	26.81	26.1	23.8	19.9	15.0	10.5	7.00	4.77	3.69		
155	4.17	5.86	8.34	11.61	15.41	20.13	24.03	26.93	27.40	26.82	24.30	20.36	15.45	10.75	7.23	4.63	3.60		
160	3.92	6.30	8.81	12.54	16.22	21.51	25.55	28.43	28.84	28.24	25.54	21.44	16.45	11.25	7.53	4.09	3.56		
165	3.50	6.86	9.17	13.83	17.50	22.61	26.65	29.53	29.86	29.26	26.56	22.46	17.45	12.25	7.83	3.76	3.41		
170	3.03	7.17	9.42	14.67	18.46	23.56	27.60	30.48	30.81	30.21	27.51	23.41	18.45	13.25	8.03	3.46	3.24		
175	2.73	7.82	10.84	16.85	20.97	25.05	29.09	31.97	32.30	31.70	29.00	24.90	19.85	14.25	8.83	3.06	2.58		
180	3.04	8.01	11.94	18.83	22.67	26.50	30.42	33.30	33.63	33.03	30.33	26.23	21.18	15.18	9.63	2.79	2.84		

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
Fluorescent Ballast Analyzer	HB-6B	HZTE002-01	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 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.

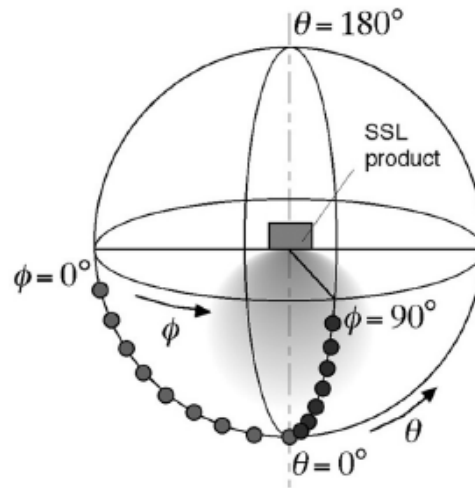
### **Color Spatial Uniformity**

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  $10^\circ$  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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