



## **LM-79-08 Test Report**

for

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

Building 9, Lane 888, Tianlin Road  
Shanghai, China

**InstantFit LEDtube**

**Model: 9290011197(2 lamps+ballast ICN-2P32-N)**

**Laboratory: Leading Testing Laboratories**

No.1805, DongLiu road, BinJiang District, Hangzhou, China

Tel: +86-571-56680806

[www.ledtestlab.com](http://www.ledtestlab.com)

Report No.: HZ14060013j

Review by:

*April Zou*

Engineer: April Zou  
Jul. 01, 2014

Approved by:



*Jim Zhang*

Manager: Jim Zhang  
Jul. 01, 2014

## Test Summary

Sample Tested: 9290011197(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	38.1	0.9976	3971.0	104.2	5.62

### Photometric and Colorimetric Measurements for each lamp

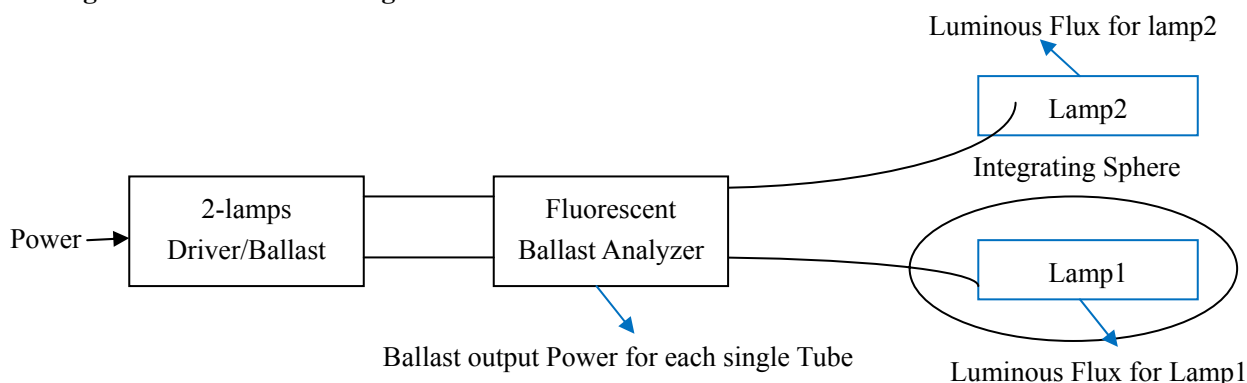
Sample Number	Luminous Flux(lm)	Test power (W)(bare tube)	Efficiency for single Tube (lm/W)	Correlated Color Temperature (K)
1#	1975.0	15.5	127.4	3432
2#	1996.0	15.6	127.9	3430
Sample Number	Color Rendering Index Ra	Color Rendering Index R9	Chromaticity Coordinate x	Chromaticity Coordinate y
1#	82.5	19	0.4080	0.3899
2#	82.3	17.7	0.4088	0.3917

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

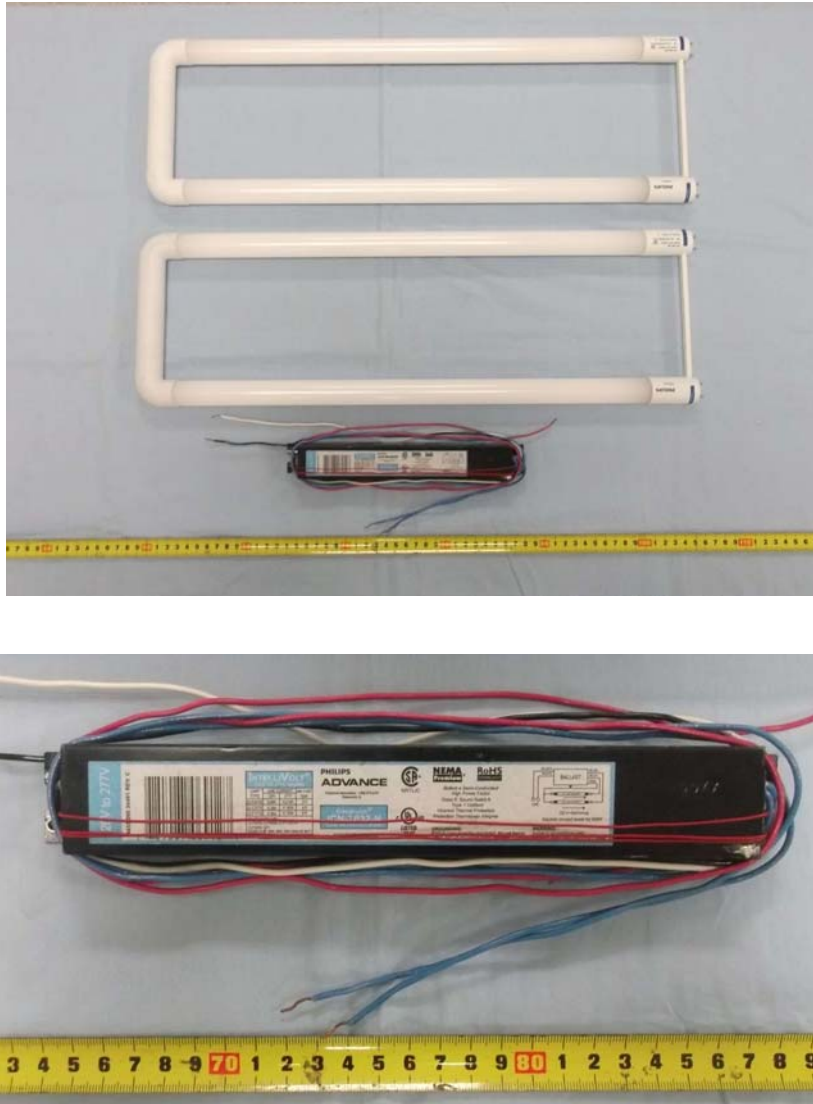


Figure 1- Overview of the sample

### Equipment Under Test (EUT)

<b>Name</b>	: InstantFit LEDtube
<b>Model</b>	: 9290011197(2 lamps+ballast ICN-2P32-N)
<b>Electrical Ratings</b>	: 120V AC, 60Hz, 16.5W
<b>Product Description</b>	: 16.5T8/24-3500 IF-6U 10/1, G13 base, 3500K, 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	80.8	80.4
Test Current (A)	0.319		R2	88.8	88.5
Power Factor	0.9976		R3	94.2	94.1
Test power (W) (ballast + 2 tubes)	38.1		R4	79.9	79.8
Luminous Efficacy (lm/W)	104.2		R5	80	79.6
THD A%	5.62		R6	83.7	83.2
Total Luminous Flux (lm)	1975.0	1996.0	R7	86.5	86.5
Test power (W) (bare tube)	15.5	15.6	R8	66.5	66.1
Efficiency for single Tube (lm/W)	127.4	127.9	R9	19	17.7
Color Rendering Index (CRI)	82.5	82.3	R10	72.8	72
R9	19	17.7	R11	76.8	76.7
Correlated Color Temperature (CCT) (K)	3432	3430	R12	61.4	60.8
Chromaticity (Chroma x, Chroma y)	(0.4080, 0.3899)	(0.4088, 0.3917)	R13	82.5	82
Chromaticity (Chroma u, Chroma v)	(0.2378, 0.3409)	(0.2376, 0.3415)	R14	96.6	96.5
Chromaticity (Chroma u', Chroma v')	(0.2378, 0.5113)	(0.2376, 0.5122)			
Duv	0.0013	0.0007			

Table 2: Test data per Sphere-Spectroradiometer Method

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

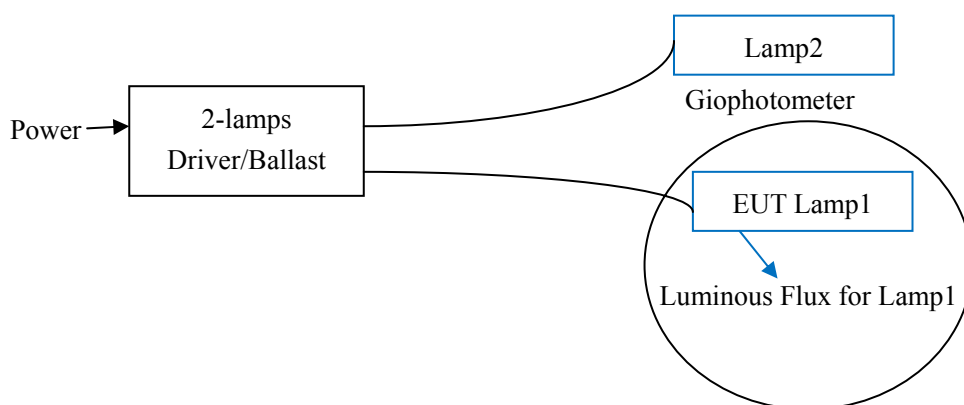
### Goniophotometer Method

Test ambient temperature was 25.5°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)	0.312
Power Factor	0.9973
Test power (W) (ballast + 2 tubes)/2	18.7
Luminous Efficacy (lm/W)	105.3
Total Luminous Flux (lm) (Single tube)	1970.0
Test power (W) (bare tube)	15.5
Luminous Efficacy (lm/W) (bare tube)	127.1
Beam Angle (°)	110.2 (0°-180°)/ 164.9 (90°-270°)
Center Beam Candle Power (cd)	468
Maximum Beam Candle Power (cd)	468.6 (At: C=80.0, Gamma=2.0)
Spacing Criteria	1.24 (0°-180°)/ 1.38(90°-270°)
Zonal Lumens in the 0°-60°Zone	58.62%
Zonal Lumens in the 60°-90°Zone	29.51%
Zonal Lumens in the 90°-120°Zone	9.20%
Zonal Lumens in the 120°-180°Zone	2.67%

Table 3: Test data per Goniophotometer Method

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

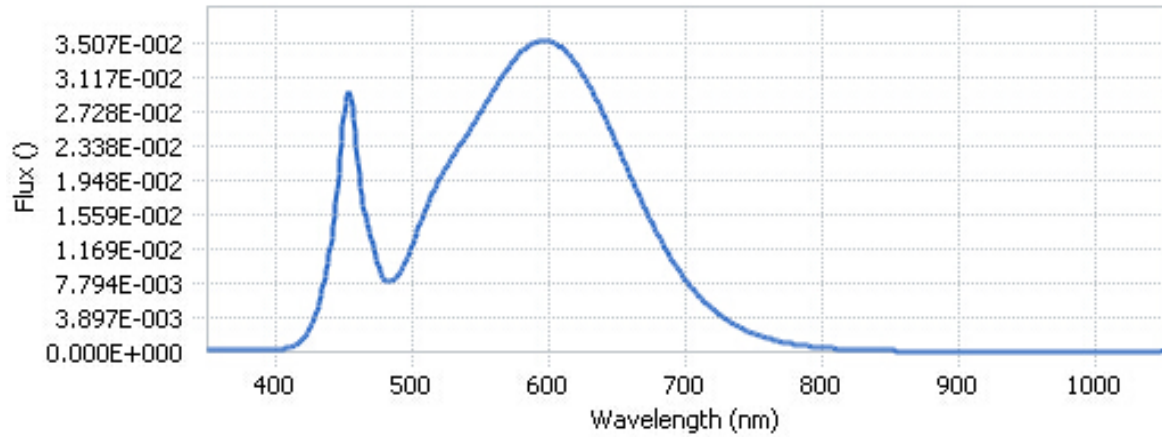
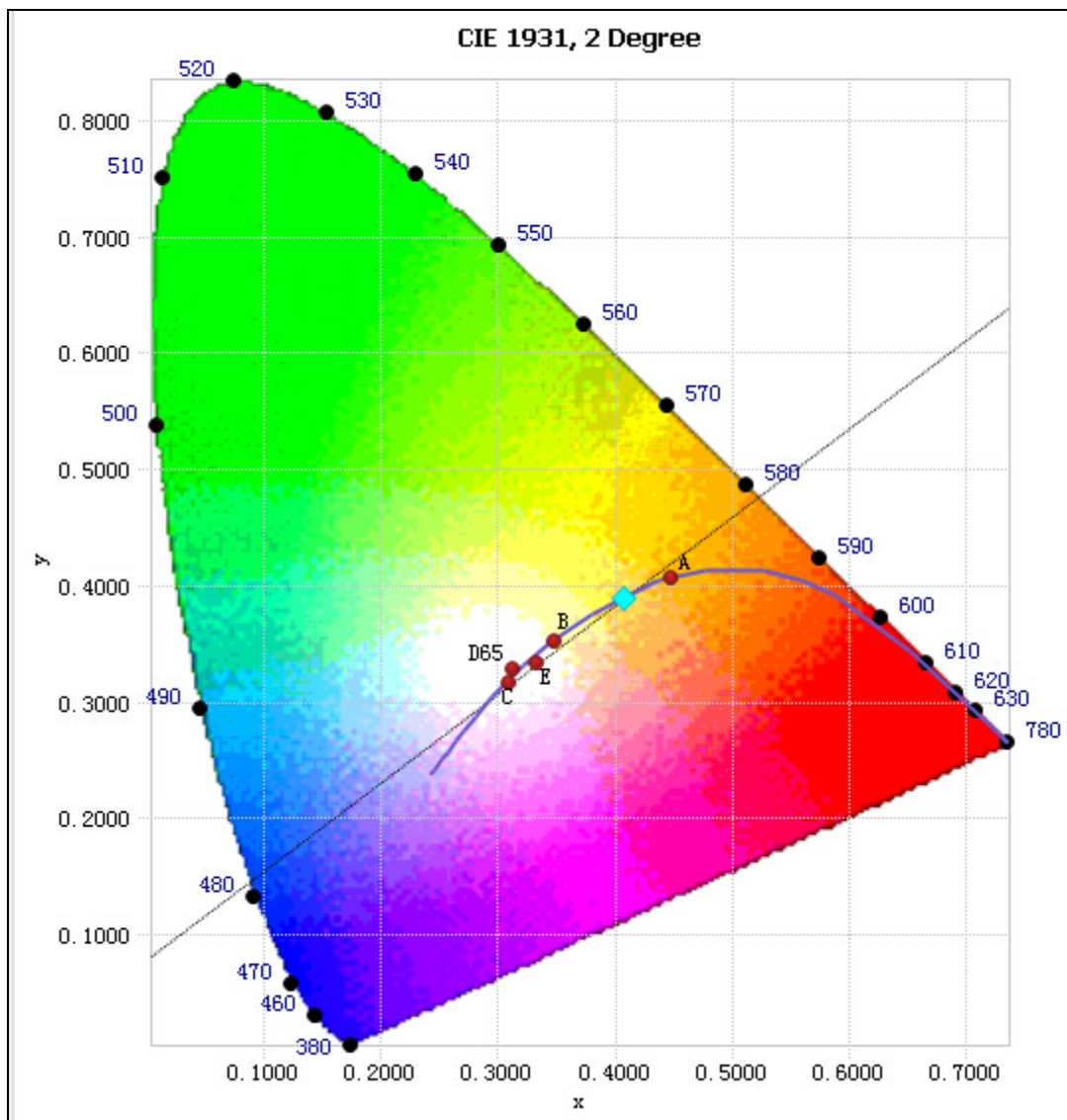


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.27E-04	485	8.06E-03	590	3.51E-02	695	9.31E-03
385	2.03E-04	490	8.79E-03	595	3.54E-02	700	8.16E-03
390	2.27E-04	495	1.03E-02	600	3.54E-02	705	7.17E-03
395	2.32E-04	500	1.22E-02	605	3.50E-02	710	6.31E-03
400	2.58E-04	505	1.44E-02	610	3.45E-02	715	5.52E-03
405	3.14E-04	510	1.64E-02	615	3.37E-02	720	4.83E-03
410	4.58E-04	515	1.81E-02	620	3.27E-02	725	4.22E-03
415	8.16E-04	520	1.97E-02	625	3.15E-02	730	3.66E-03
420	1.50E-03	525	2.11E-02	630	3.01E-02	735	3.16E-03
425	2.74E-03	530	2.23E-02	635	2.85E-02	740	2.74E-03
430	4.77E-03	535	2.35E-02	640	2.69E-02	745	2.37E-03
435	7.81E-03	540	2.46E-02	645	2.52E-02	750	2.06E-03
440	1.20E-02	545	2.59E-02	650	2.35E-02	755	1.79E-03
445	1.85E-02	550	2.72E-02	655	2.16E-02	760	1.55E-03
450	2.70E-02	555	2.85E-02	660	1.99E-02	765	1.34E-03
455	2.89E-02	560	2.99E-02	665	1.81E-02	770	1.16E-03
460	2.16E-02	565	3.11E-02	670	1.64E-02	775	9.99E-04
465	1.59E-02	570	3.22E-02	675	1.48E-02	780	8.71E-04
470	1.28E-02	575	3.34E-02	680	1.32E-02		
475	9.82E-03	580	3.42E-02	685	1.18E-02		
480	8.09E-03	585	3.48E-02	690	1.05E-02		

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

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



Tristimulus values(x, y): (0.4080, 0.3899)

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

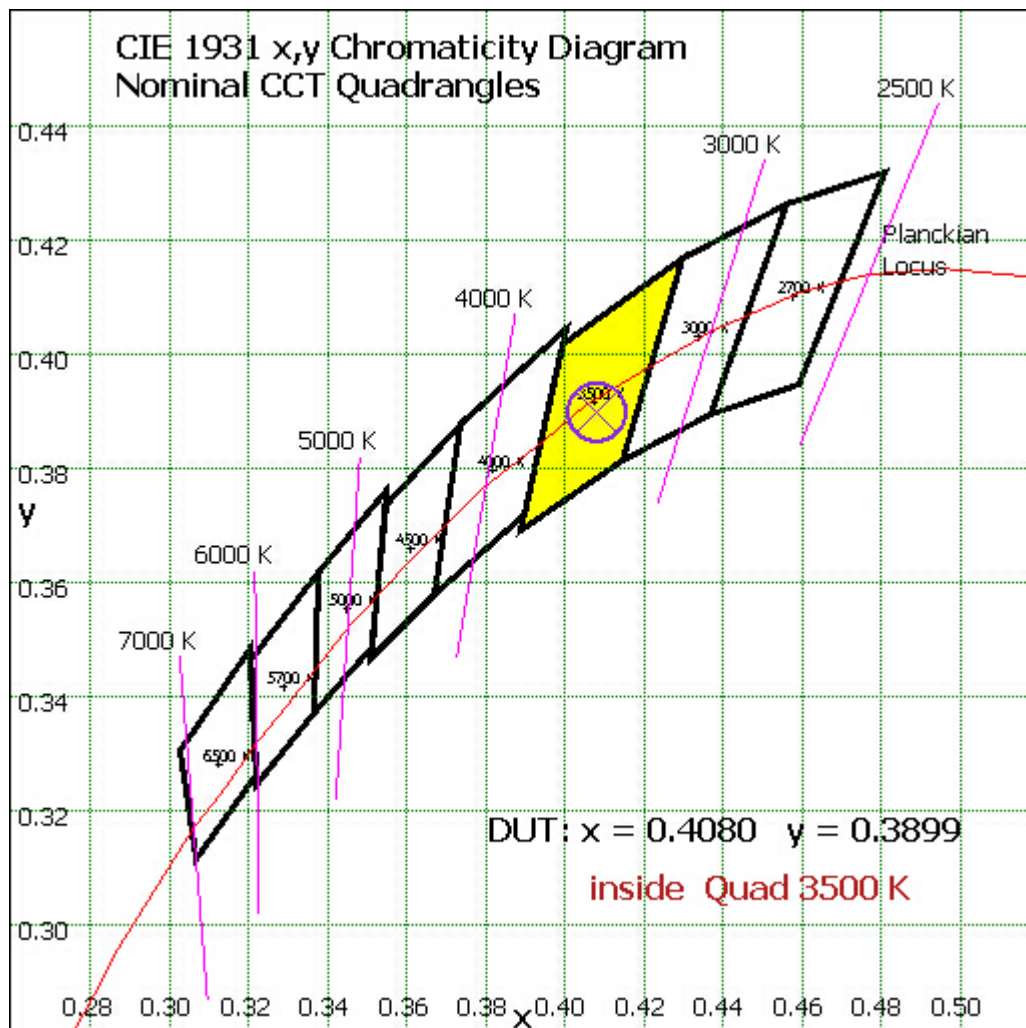


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

### Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	44.397	2.25%
10- 20	128.329	6.51%
20- 30	198.191	10.06%
30- 40	246.722	12.52%
40- 50	269.886	13.70%
50- 60	267.25	13.57%
60- 70	242.151	12.29%
70- 80	201.185	10.21%
80- 90	138.063	7.01%
90-100	74.396	3.78%
100-110	64.666	3.28%
110-120	42.213	2.14%
120-130	26.884	1.36%
130-140	15.034	0.76%
140-150	6.712	0.34%
150-160	2.627	0.13%
160-170	1.102	0.06%
170-180	0.192	0.01%
Total	1970.0	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1154.775	58.62%
60- 90	581.399	29.51%
0-90	1736.174	88.13%
90- 180	233.826	11.87%
0- 180	1970.0	100%

Table 5: Zonal Lumen Data

### Illuminance Plots- Goniophotometer Method

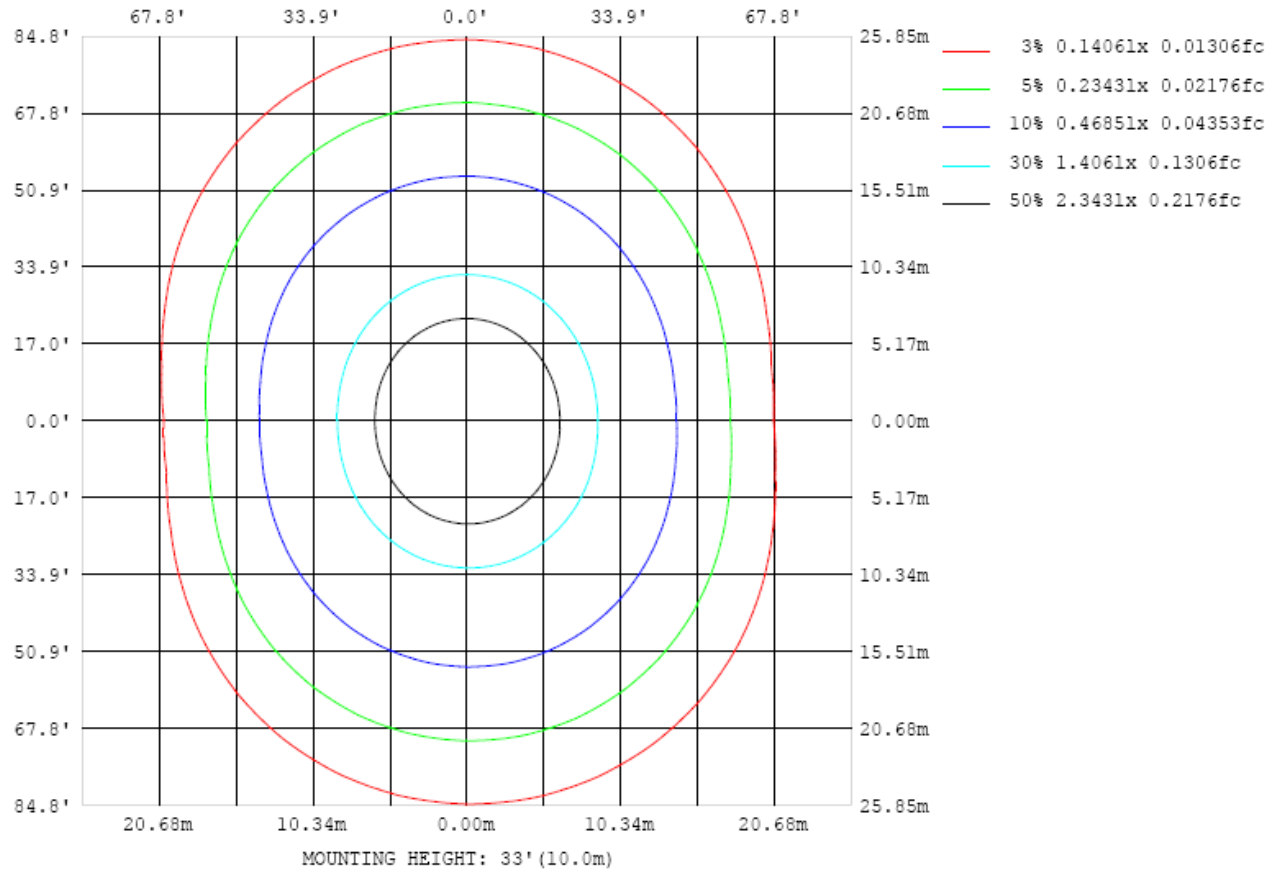


Chart 4: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

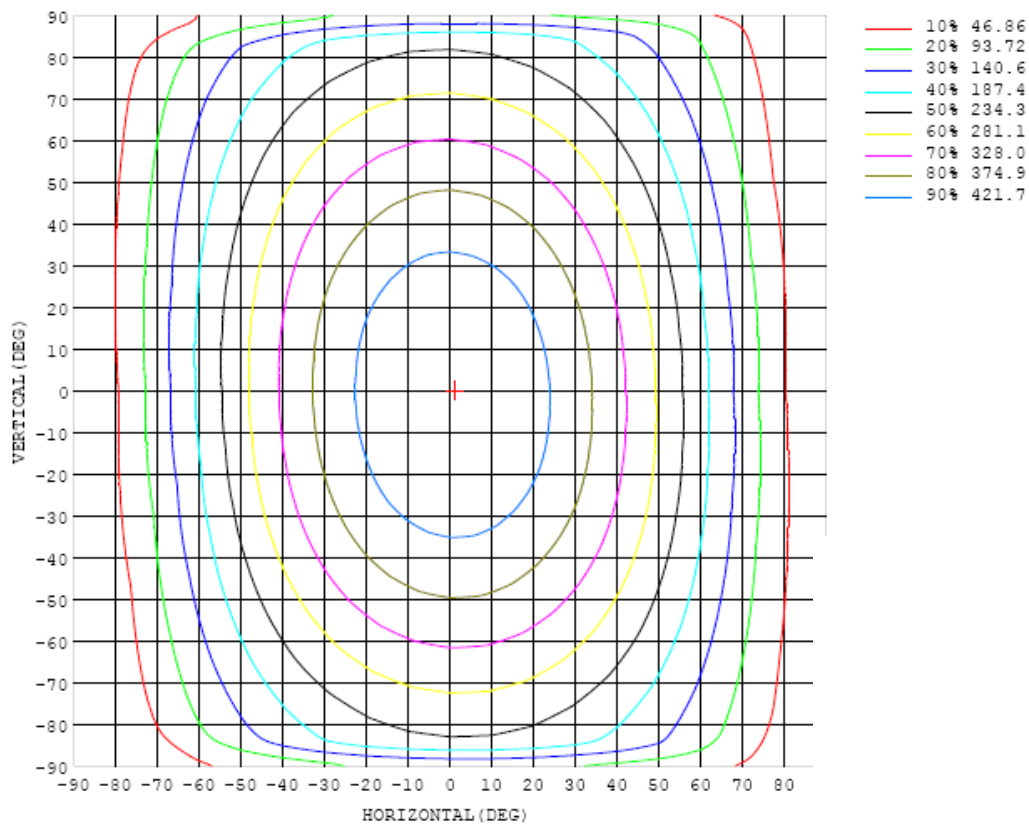


Chart 5: Isocandela Plot

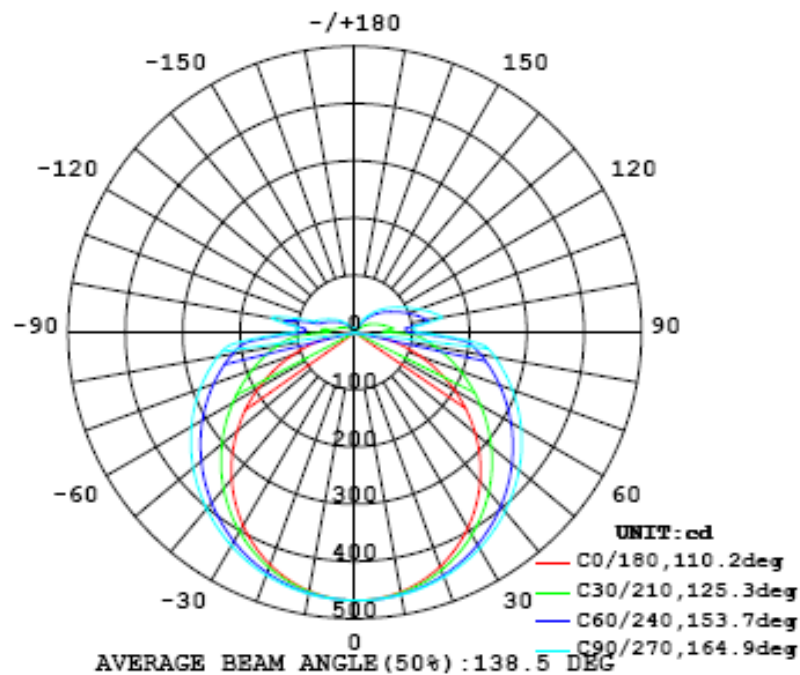


Chart 6: Polar Candela Distribution

## 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	468	468	468	468	468	468	468	468	468	468	468	468	468	468	468	468	468	468	468
5	466	467	467	467	467	468	468	468	468	468	468	467	467	467	466	466	466	466	466
10	460	461	461	462	463	464	465	465	466	465	465	464	463	462	461	460	459	459	459
15	450	450	452	454	456	458	459	461	461	461	460	459	457	455	453	450	449	448	447
20	435	436	439	442	445	448	451	453	455	455	454	451	448	445	441	437	434	432	432
25	417	418	422	426	432	437	441	444	446	446	444	441	437	431	426	420	416	413	412
30	394	397	402	408	415	422	428	433	435	435	433	429	423	416	408	401	394	391	390
35	369	372	379	387	396	405	413	419	422	422	420	414	407	398	388	378	370	365	363
40	340	344	353	364	375	387	396	403	407	408	405	398	389	377	365	353	343	336	334
45	308	314	325	338	352	366	378	386	391	392	388	380	369	355	340	326	313	304	302
50	274	281	294	311	328	344	358	368	373	374	370	361	348	332	314	297	281	270	268
55	238	247	263	282	302	321	336	348	354	355	350	341	326	308	287	267	248	234	231
60	201	211	230	253	276	297	314	327	334	335	330	319	303	283	260	236	214	197	194
65	162	175	198	224	250	273	292	305	313	314	309	297	280	258	233	205	179	159	155
70	122	138	166	196	224	249	269	283	291	292	287	275	257	233	206	176	145	121	116
75	83.3	103	135	168	199	225	246	261	269	270	265	252	234	209	180	147	113	84.0	77.7
80	48.2	72.2	108	143	174	201	223	239	247	248	243	230	211	186	155	121	84.6	51.7	42.9
85	19.8	46.9	83.1	119	151	178	198	209	214	214	210	200	184	160	129	94.8	58.7	24.9	15.8
90	3.97	22.7	42.7	66.1	73.7	85.9	95.9	105	109	110	107	99.7	88.9	74.7	64.0	39.8	20.5	5.44	1.20
95	1.98	16.5	42.6	65.6	74.5	81.8	89.2	96.3	101	102	99.1	93.8	86.9	77.9	66.9	47.7	23.3	5.16	1.74
100	1.70	11.8	33.6	59.8	85.2	108	128	145	153	155	150	137	117	95.0	69.6	42.9	19.6	4.62	1.83
105	1.97	8.84	26.9	50.5	74.3	95.1	114	127	136	138	133	123	106	85.3	61.4	37.5	16.8	3.32	1.90
110	2.10	5.43	22.0	42.4	63.6	82.4	98.9	111	117	119	115	106	91.7	74.0	53.2	32.1	13.8	2.53	1.94
115	1.96	4.22	17.2	35.2	54.2	71.2	85.1	95.7	102	103	99.5	91.3	78.9	63.5	45.0	27.3	10.9	2.49	1.96
120	1.94	3.77	12.5	29.2	45.2	60.9	73.1	82.2	87.5	88.6	85.6	78.5	68.1	53.6	38.8	22.0	6.88	2.37	1.94
125	1.77	3.39	7.48	22.0	37.9	50.9	62.4	70.4	74.6	75.7	73.2	67.4	57.6	45.7	31.6	17.0	4.99	2.29	1.96
130	1.81	3.09	6.21	15.4	29.3	42.5	52.2	59.2	63.3	64.2	61.9	56.5	48.2	37.3	24.8	10.9	4.45	2.22	2.01
135	1.89	2.91	5.40	9.17	21.5	32.4	42.1	48.7	52.1	52.8	50.8	46.0	38.6	29.0	17.3	7.12	3.97	2.17	2.09
140	1.87	2.76	4.68	7.48	12.2	23.0	31.4	37.2	40.4	41.3	39.7	35.6	29.1	20.0	9.50	5.98	3.57	2.16	2.15
145	1.94	2.67	3.98	6.20	8.73	12.5	20.2	26.2	29.4	30.1	28.5	24.7	18.1	10.5	7.54	5.08	3.23	2.16	2.19
150	2.00	2.59	3.57	5.12	6.97	8.91	10.7	13.2	15.8	16.6	15.3	12.1	9.94	8.07	6.11	4.38	3.01	2.19	2.24
155	2.09	2.49	3.18	4.08	5.52	6.84	8.09	9.04	9.70	9.81	9.47	8.71	7.60	6.29	4.98	3.66	2.80	2.22	2.23
160	1.93	2.20	2.73	3.47	4.20	5.24	5.99	6.62	6.99	7.07	6.86	6.37	5.67	4.91	3.86	3.11	2.52	2.17	2.19
165	1.76	2.20	2.47	2.93	3.39	3.92	4.31	4.72	5.02	5.06	4.93	4.61	4.02	3.56	3.10	2.66	2.24	2.03	1.99
170	1.53	1.71	2.25	2.49	2.77	2.97	3.16	3.32	3.41	3.42	3.27	3.09	2.94	2.74	2.39	2.05	1.85	1.77	1.75
175	1.59	1.50	1.60	1.82	2.33	2.31	2.34	2.46	2.50	2.48	2.46	2.37	2.07	1.84	1.76	1.65	1.64	1.63	1.67
180	1.77	1.75	1.70	1.67	1.74	1.80	1.57	1.59	1.21	1.72	1.04	1.36	1.51	1.62	1.67	1.71	1.73	1.72	1.78

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	468	468	468	468	468	468	468	468	468	468	468	468	468	468	468	468	468		
5	466	466	466	466	466	466	467	467	467	467	467	467	467	467	466	466	466		
10	459	459	460	460	461	462	463	464	464	464	463	463	462	461	461	460	460		
15	447	449	450	452	454	456	457	458	459	458	458	456	455	453	452	450	450		
20	432	434	437	440	444	447	449	451	451	451	449	447	444	441	439	436	435		
25	414	417	421	426	431	435	439	441	442	441	439	435	431	427	422	419	417		
30	391	396	402	409	416	422	426	429	430	429	426	421	415	409	403	398	395		
35	366	372	380	389	398	406	412	416	417	415	411	405	397	389	380	374	369		
40	338	346	356	367	379	388	396	401	402	400	395	387	377	366	356	347	341		
45	307	317	330	344	358	370	379	384	386	383	377	367	355	342	329	317	310		
50	274	287	303	320	336	349	360	366	368	365	357	346	332	316	300	286	277		
55	240	255	274	294	313	328	340	347	349	345	337	324	308	289	270	253	241		
60	204	223	246	269	289	307	320	327	329	325	316	301	283	262	240	219	205		
65	168	191	217	243	266	285	298	306	308	304	294	278	258	235	209	185	167		
70	133	160	190	218	242	262	277	285	287	283	272	255	234	208	180	152	129		
75	98.9	131	164	193	219	240	254	263	265	260	249	232	210	182	152	120	92.2		
80	68.3	104	138	169	196	217	232	241	243	238	226	209	186	158	125	90.4	58.4		
85	41.8	76.7	111	142	161	185	196	204	207	205	198	184	160	134	101	65.4	31.3		
90	11.6	29.4	47.9	65.1	80.1	92.0	101	106	107	104	97.5	88.5	79.0	67.0	52.4	35.0	10.7		
95	12.2	33.1	59.3	71.8	82.0	89.3	95.0	98.3	98.7	96.0	89.9	81.4	72.9	64.9	54.5	21.8	6.31		
100	9.81	22.6	35.3	55.5	92.1	121	138	147	148	143	131	109	75.0	40.9	29.1	16.8	4.13		
105	7.59	19.1	30.3	40.9	51.9	62.0	69.4	77.3	79.7	73.7	66.4	57.6	46.3	33.7	23.0	12.5	3.61		
110	6.29	15.4	25.4	34.8	44.1	53.3	60.0	63.9	64.7	62.4	57.2	49.1	38.9	27.5	18.2	9.14	3.27		
115	5.22	11.9	20.7	29.0	37.2	45.2	51.3	54.8	55.5	53.4	48.6	41.4	32.4	22.5	14.0	7.15	2.99		
120	4.49	9.58	16.2	23.7	30.9	38.0	43.3	46.3	46.9	45.1	40.8	34.5	26.6	18.0	10.5	5.63	2.70		
125	4.76	7.55	12.3	18.6	25.3	31.4	35.9	38.6	39.1	37.4	33.7	28.2	21.4	13.5	8.19	4.53	2.50		
130	4.18	6.02	9.63	13.6	19.6	25.2	29.2	31.5	31.9	30.5	27.3	22.3	16.2	10.4	6.24	4.16	2.42		
135	3.70	5.19	7.37	10.5	13.8	19.1	22.6	24.6	25.0	23.6	20.8	16.7	12.2	8.03	4.87	4.34	2.33		
140	3.40	6.33	5.68	8.01	10.8	13.6	16.5	18.0	18.3	17.3	15.3	12.4	9.30	6.05	4.07	3.70	2.30		
145	3.17	5.12	5.18	5.92	7.98	10.0	12.2	13.2	13.3	12.7	11.3	9.22	6.81	4.62	5.73	3.23	2.28		
150	2.98	4.17	6.57	4.92	5.72	7.10	8.09	9.40	9.54	9.01	7.97	6.59	5.02	7.54	4.35	2.77	2.19		
155	2.67	3.57	4.89	7.10	7.32	5.09	5.61	5.68	6.44	6.15	5.53	5.07	8.38	5.73	3.68	2.48	2.33		
160	2.34	2.83	3.62	4.77	6.41	7.88	9.28	9.53	8.28	9.82	9.21	7.87	6.03	4.30	2.78	2.16	2.05		
165	2.03	2.24	2.66	3.11	3.73	4.42	5.76	6.51	6.67	6.56	6.12	5.46	4.24	2.86	2.34	1.98	1.90		
170	1.76	1.87	2.01	2.20	2.50	2.74	2.81	2.88	3.01	3.41	3.30	2.93	2.45	2.06	1.83	1.70	1.59		
175	1.67	1.72	1.72	1.69	1.67	1.70	1.69	1.60	1.43	1.31	1.09	1.18	1.42	1.48	1.44	1.43	1.53		
180	1.78	1.75	1.71	1.67	1.71	1.74	1.58	1.49	1.45	1.18	1.15	1.30	1.46	1.53	1.63	1.69	1.69		

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.

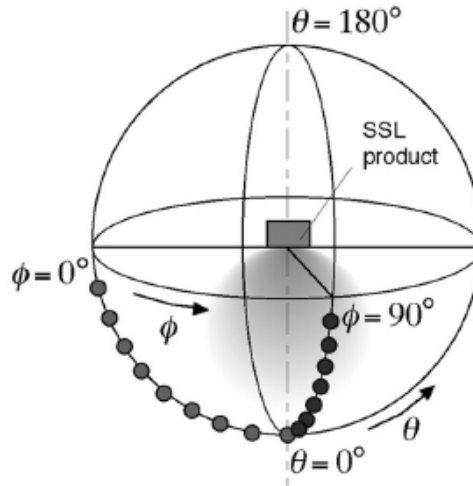
### **Color Spatial Uniformity**

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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