



PHOTOMETRIC TESTING & EVALUATION TO IES LM-79-08

Sample Tested
iGU1030231D 3000K 23D

Prepared for:

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Technical Report Number
2455398 - iGU1030231D 3000K 23D

September 9, 2011

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Program Description

Photometric and electrical testing of an “iGU1030231D 3000K 23D” replacement lamp to IES LM-79-08.

Executive Summary

Sample Tested = iGU1030231D 3000K 23D

Luminous Efficacy* (Lumens/Watt)	Luminous Flux* (Lumens)	Input Power* (Watts)	Power Factor*
69.28	285.5	4.121	0.972

CCT (K)*	CRI*	Stabilization Time (Light & Power)
3037.2	81.7	33 minutes

* The above results are recorded / derived from measurements made using an Integrating Sphere



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Sample

The following sample was submitted for evaluation:

MSI SSL – iGU1030231D 3000K 23D



iGU1030231D 3000K 23D

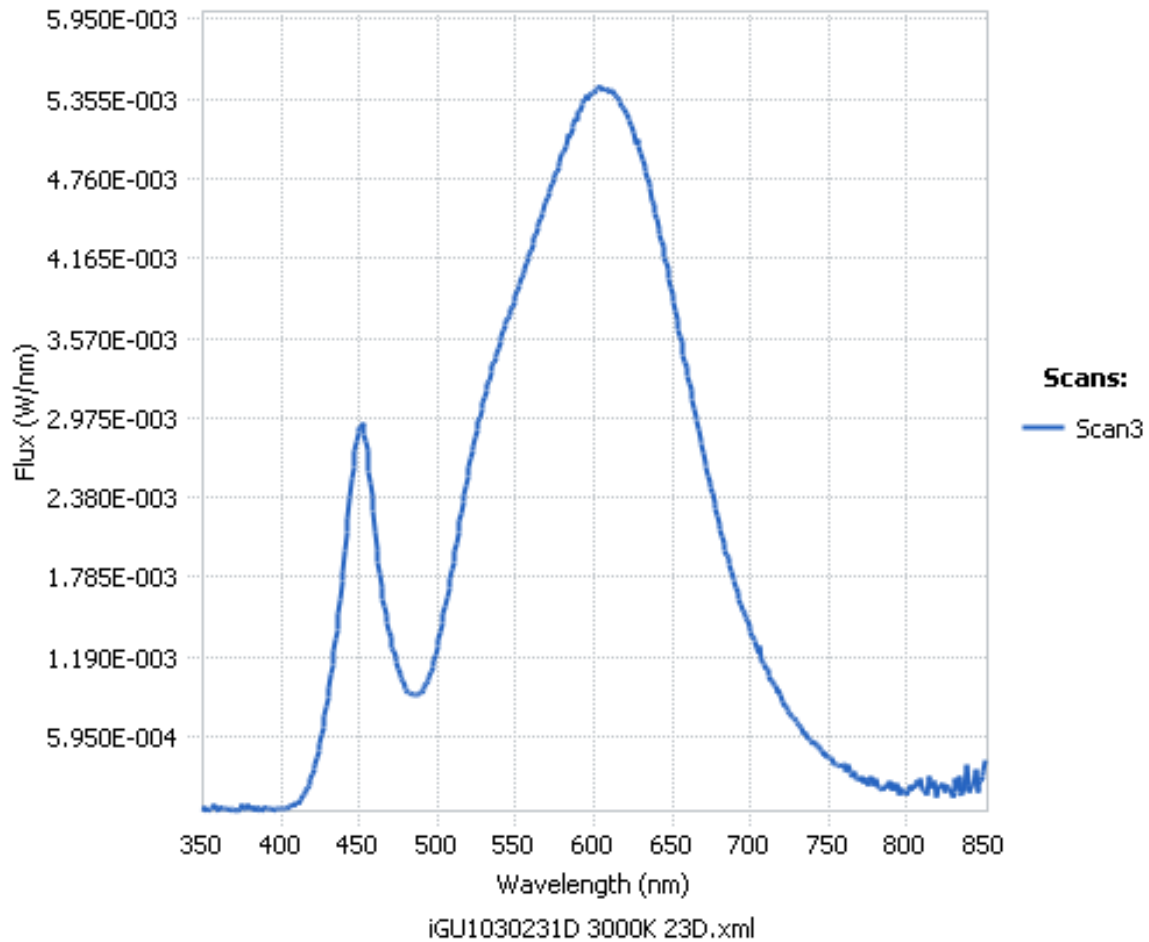


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Test Results –		
The following results were measured after stabilization of the sample in the Integrating Sphere (unless otherwise stated). Stability is reached when the variation of 3 readings of light output and electrical power, taken 15 minutes apart, is less than 0.50% (in accordance with IES LM-79-08).		
Key Photometric Results	Sample Reference	
	iGU1030231D 3000K 23D	
	Integrating Sphere	Goniophotometer
Luminous Efficacy (Lumens/Watt)	69.28	68.60
Total Luminous Flux (Lumens)	285.5	281.25
Total Radiant Flux (Watts)	0.9390	
Correlated Color Temperature (CCT)	3037.2	
Color Rendering Index (CRI)	81.7	
R9 Value	20.3	
Chromaticity (Chroma x / Chroma y)	0.4327 / 0.4000	
Chromaticity (Chroma u / Chroma v)	0.2496 / 0.3461	
Chromaticity (Chroma u' / Chroma v')	0.2496 / 0.5191	
D _{uv} Value	-0.00107	
Stabilization Time (Light and Power)	Approx. 33 minutes	
Total Run Time – Integrating Sphere	38 minutes	
Total Run Time – Goniophotometer	95 minutes	
Spacing Criteria	0.54 (0° – 180°) / 0.56 (90° – 270°)	
Electrical Input Results:	Sample Reference	
	iGU1030231D 3000K 23D	
	Integrating Sphere	Goniophotometer
Input Power (Watts)	4.121	4.1
Input Voltage (Volts AC)	120.0	120.0
Input Current (Amps)	0.035	0.035
Input Frequency (Hertz)	60.0	60.0
Power Factor	0.972	0.985
Additional Information	Sample Reference	
	iGU1030231D 3000K 23D	
Ambient Temperature	25.7°C	
Integrating Sphere Detector	CDS 600 Spectroradiometer	
Absorption Correction used?	Yes	

Spectral Flux

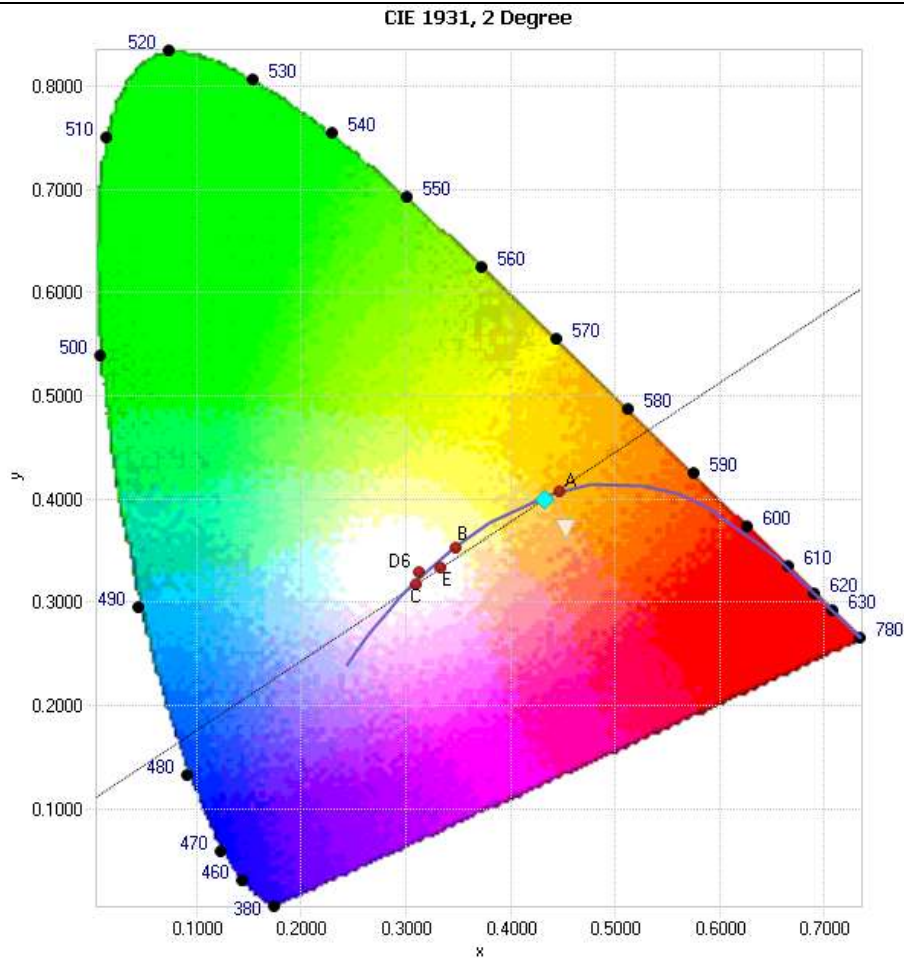
The following graph shows the spectral response curve of the radiant flux for the sample:



Spectral response of the Radiant Flux
(350nm to 850nm – calibrated range of the Spectroradiometer).

Chromaticity Diagram

The following image shows the chromaticity diagram for the sample:



Tristimulus values (from page 6):
 $x / y = 0.4327 / 0.4000$

The locations on the diagram of the tristimulus coordinates are indicated by the blue diamond.



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Test Results – Flux Distribution – Zonal Lumen Summary

The following table depicts the zonal lumen distribution for the sample:

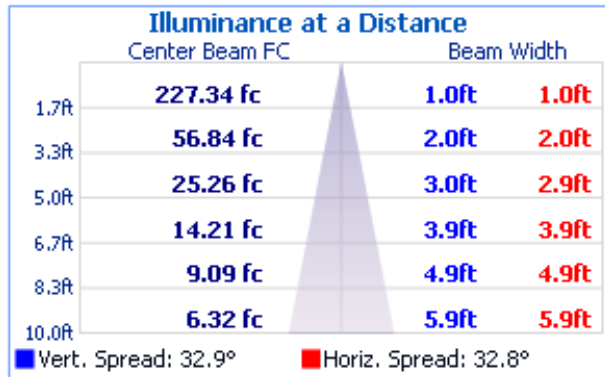
Zone	Lumens	% Total
0 - 10	53.5	19.00%
10 - 20	96.5	34.30%
20 - 30	56.8	20.20%
30 - 40	30.1	10.70%
40 - 50	17.7	6.30%
50 - 60	10.6	3.80%
60 - 70	6.4	2.30%
70 - 80	3.6	1.30%
80 - 90	1.5	0.50%
90 - 100	0.6	0.20%
100 - 110	0.6	0.20%
110 - 120	0.7	0.20%
120 - 130	0.8	0.30%
130 - 140	0.7	0.20%
140 - 150	0.5	0.20%
150 - 160	0.3	0.10%
160 - 170	0.3	0.10%
170 - 180	0.1	0%
Total	281.25 Lumens	100%

Zonal Lumen Summary

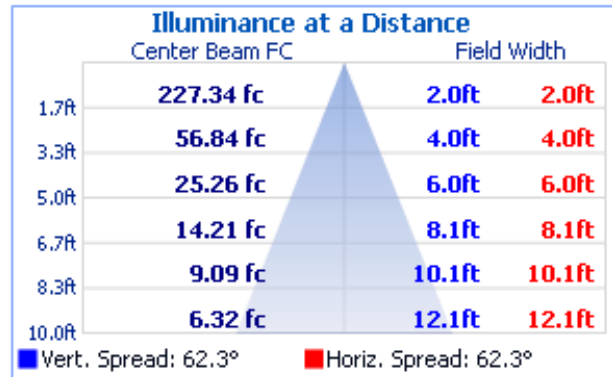
Zone	Lumens	% Lamp / Luminaire
0 - 60	265.2	94.3 %
60 - 90	11.6	4.1 %
0 - 90	276.7	98.4 %
90 - 180	4.5	1.6 %
0 - 180	281.3	100 %

Test Results – Illuminance Plots

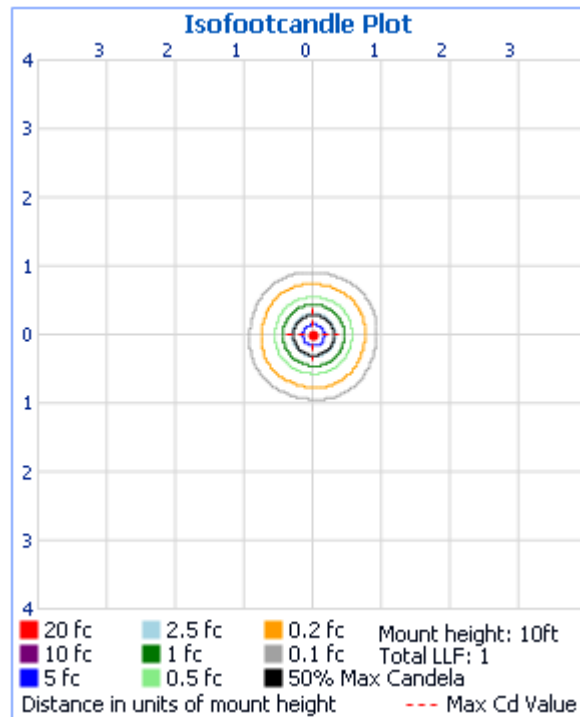
The following images depict the illuminance characteristics of the luminaire.



Beam Angle



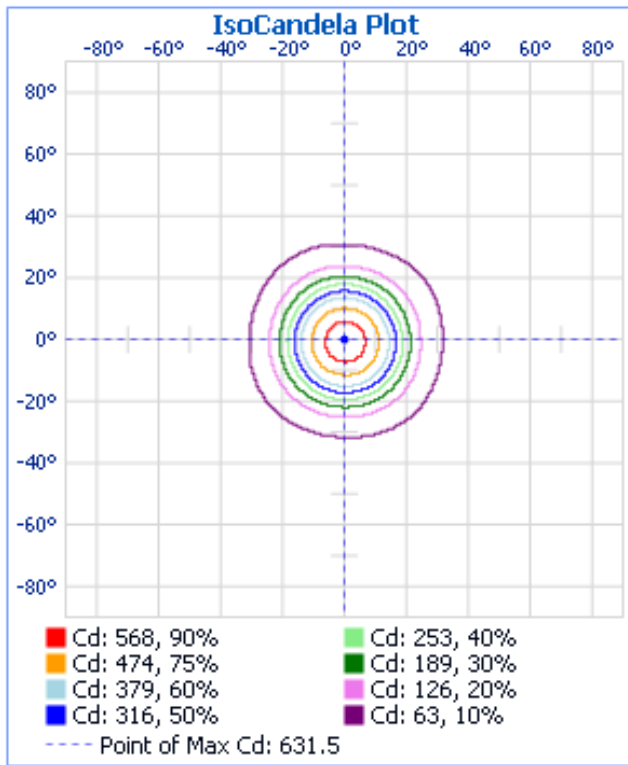
Field Angle



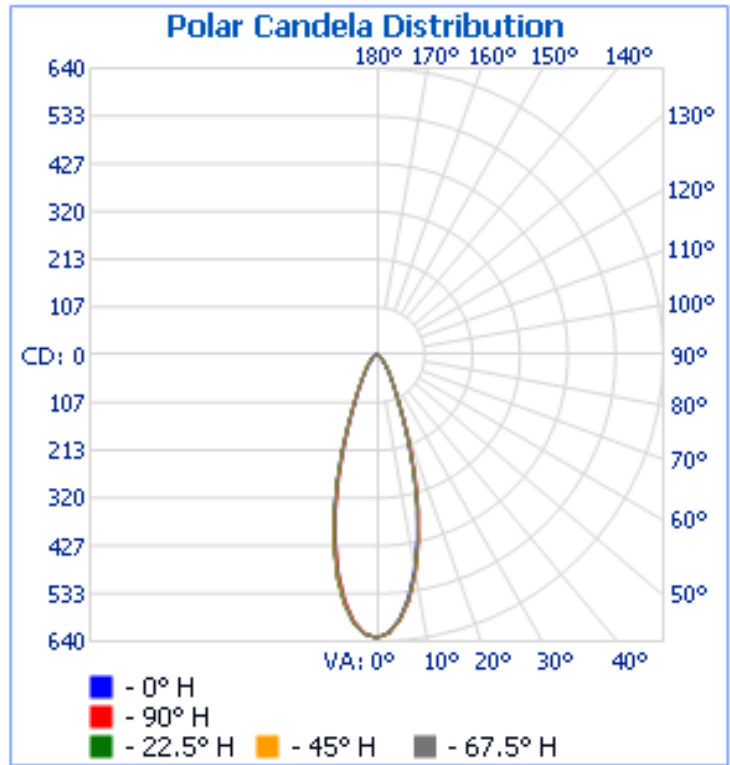
Illuminance Plot (Footcandles)

Test Results – Candela Plots

The following images depict the luminous intensity distribution characteristics of the luminaire.



IsoCandela Plot



Polar Candela Distribution



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Test Results – Candela Tabulation

The following table provides the tabulated Candela measurements:

	0.0	22.5	45.0	67.5	90.0	112.5	135.0	157.5	180.0	202.5	225.0	247.5	270.0	292.5	315.0	337.5	360.0
0.0	632	632	632	632	632	632	632	632	632	632	632	632	632	632	632	632	632
2.5	620	620	621	622	622	624	624	624	624	624	623	623	622	621	620	619	619
5.0	590	591	593	594	595	598	600	600	600	600	599	597	595	594	592	589	590
7.5	544	548	550	550	552	558	561	560	559	561	559	554	551	551	548	544	544
10.0	486	491	494	492	495	504	508	505	504	507	505	498	493	492	489	485	486
12.5	419	423	424	425	430	438	442	442	441	443	441	433	427	423	420	416	418
15.0	347	347	349	353	358	364	369	371	371	371	368	362	355	348	344	343	346
17.5	272	273	276	280	286	289	293	296	297	295	292	287	280	271	268	268	272
20.0	204	208	210	213	217	221	223	225	226	225	223	217	211	204	201	200	204
22.5	150	154	156	157	160	164	166	166	166	167	165	160	155	151	149	148	150
25.0	112	116	116	116	118	122	123	122	122	123	123	119	115	115	113	111	112
27.5	87	90	90	88	89	93	93	92	92	94	94	91	89	90	89	87	87
30.0	69	72	71	68	69	73	73	71	71	74	75	72	70	72	72	69	69
32.5	56	59	58	55	55	58	59	56	56	59	60	57	56	59	59	56	56
35.0	45	48	47	44	45	48	48	45	45	48	50	47	46	49	49	46	45
37.5	37	40	39	36	37	40	40	37	37	40	41	38	38	41	41	38	37
40.0	31	34	33	30	30	33	33	30	30	33	34	32	31	34	34	31	31
42.5	26	28	27	25	25	28	28	25	25	28	28	26	26	29	29	26	26
45.0	22	23	23	21	21	23	23	21	21	23	24	22	22	24	24	22	22
47.5	18	20	19	18	18	20	20	18	18	19	20	19	18	20	20	18	18
50.0	16	17	16	15	15	16	17	15	15	16	17	16	16	17	17	16	16
52.5	13	14	14	13	13	14	14	13	13	14	14	13	13	14	14	13	13
55.0	11	12	12	11	11	12	12	12	11	12	12	11	11	12	12	11	11
57.5	10	10	10	9	10	10	10	10	10	10	10	10	10	10	10	10	10
60.0	8	9	9	8	8	9	9	9	9	9	9	8	8	9	9	8	8
62.5	7	7	7	7	7	8	8	8	7	8	8	7	7	7	7	7	7
65.0	6	6	6	6	6	7	7	7	6	7	7	6	6	6	6	6	6
67.5	5	5	5	5	5	6	6	6	6	6	6	5	5	5	5	5	5
70.0	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
72.5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
75.0	3	3	3	3	3	4	4	4	3	3	3	3	3	3	3	3	3
77.5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
80.0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
82.5	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
85.0	1	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1
87.5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
90.0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1

Continued.....



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Test Results – Candela Tabulation Cont.

	0.0	22.5	45.0	67.5	90.0	112.5	135.0	157.5	180.0	202.5	225.0	247.5	270.0	292.5	315.0	337.5	360.0
92.5	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
95.0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
97.5	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1
100.0	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1
102.5	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1
105.0	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1
107.5	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1
110.0	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1
112.5	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1
115.0	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1
117.5	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1
120.0	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1
122.5	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1
125.0	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1
127.5	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1
130.0	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1
132.5	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1
135.0	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1
137.5	1	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1
140.0	1	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	1
142.5	1	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	1
145.0	1	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	1
147.5	1	1	1	1	1	0	0	0	0	0	0	0	1	1	1	1	1
150.0	1	1	1	1	1	0	0	0	0	0	0	0	1	1	1	1	1
152.5	1	1	1	1	1	0	0	0	0	0	0	0	1	1	1	1	1
155.0	1	1	1	1	1	0	0	0	0	0	0	0	1	1	1	1	1
157.5	1	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	1
160.0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
162.5	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
165.0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
167.5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
170.0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
172.5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
175.0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
177.5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
180.0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0



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Photometric Testing Information

The sample was evaluated for photometric and electrical characteristics using an integrating sphere and a goniophotometer, each located in purpose-built, temperature and humidity-controlled, draft free environments.

The integrating sphere is a 76-inch diameter sphere manufactured by Labsphere (Model# LMS760) which exhibits a “ 4π geometry” configuration according to IES LM-79-08 and is applicable for all types of LED products (directional and non-directional light projections). Its spectroradiometer is an array-type detector manufactured and calibrated by Labsphere (Model# CDS600).

The integrating sphere uses self-absorption correction to eliminate errors due to mismatches between the standard reference lamp and the test samples being measured. The auxiliary lamp used to perform this task is a halogen type lamp powered by a calibrated *Lamp Power Supply* manufactured and calibrated by Labsphere (model LPS 200). Ambient temperature (for photometric analysis) is measured using a “J-Type” thermocouple located inside the integrating sphere at the same height as the sample under test and not more than 1 meter in horizontal distance away from the sample. The thermocouple is located behind the baffle of the photo detector in order to eliminate any direct optical radiation from the sample under test.

Luminaire Stabilization.

The sample was placed inside the integrating sphere and powered by a regulated and conditioned 120.0 Volt, alternating current supply. The correlated color temperature, color rendering index, chromaticity coordinates and electrical power measurements contained in this report are the numeric **averages** of the three readings upon which stabilization is verified. The stabilization times shown on the results pages of this report denote the time of the 1st measurement (of the 3 consecutive readings) since this is the minimum time that the sample is assumed to have taken to reach stabilization.

The integrating sphere is calibrated using a quartzline halogen lamp with the following specifications:

Manufacturer: Sylvania

Model# 75Q/CL-28V

Voltage = 28.0 Volt

Wattage = 75.0 Watts

Calibration Current = 2.679 Amperes

Luminous Flux = 1538.8 Lumens

Calibration Date = 8-18-2005 (calibrated by Labsphere – NIST traceable).

Continued.....

Photometric Testing Information (continued)

The goniophotometer is calibrated using a frosted tungsten filament FDS/DZE lamp with the following specifications:

Manufacturer: General Electric
 Part Number: CSB-110
 Bulb Number: 108-A
 Voltage: 24.0 Volts
 Wattage: 150.0 Watts
 Calibration Current: 4.799 Amperes
 Luminous Intensity: 150.3 Candelas
 Calibration Date: 4-14-2009 (NIST traceable)

A *Power Analyzer* was used to measure all electrical characteristics of the sample.

CSA is an accredited Test Laboratory (TL-430)
 to IESNA LM79-08 by IAS
 (International Accreditation Service)



Equipment List:

Description	Manufacturer and Model Number	CSA Instrument Reference Number	Calibration Due Date
Integrating Sphere 76"	Labsphere LMS760	SPH200	N/A
Spectroradiometer	Labsphere CDS600	CDS600	5/2012
Auxiliary Lamp PSU	Labsphere LPS200	LPS200	2/2012
Power Analyzer	Yokogawa WT210	PA111	1/2012
Power Analyzer	Yokogawa WT210	PA108	5/2012
Regulated Power Supply	Chroma Instruments 61603	AC303	N/A
Regulated Power Supply	Chroma Instruments 61602	AC301	N/A
Thermometer (Thermocouple)	Fluke 52	TH100	8/2012

All equipment is calibrated by TMI (Technical Maintenance, Inc.) ISO / IEC 17025-2005 Accredited (Cert. 1378.01) except: Labsphere CDS600 which is calibrated by Labsphere, USA.