



PHOTOMETRIC TESTING & EVALUATION TO IES LM-79-08

Sample Tested
iGU1030321D 3000K 32D

Prepared for:

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Technical Report Number
2455398 - iGU1030321D 3000K 32D

September 9, 2011

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Program Description

Photometric and electrical testing of an “ iGU1030321D 3000K 32D” replacement lamp to IES LM-79-08.

Executive Summary

Sample Tested = iGU1030321D 3000K 32D

Luminous Efficacy* (Lumens/Watt)	Luminous Flux* (Lumens)	Input Power* (Watts)	Power Factor*
67.72	288.3	4.195	0.967

CCT (K)*	CRI*	Stabilization Time (Light & Power)
3036.3	81.7	38 minutes

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



TABLE OF CONTENTS

Sample.....	4
Test Results.....	5
Spectral Flux.....	6
Chromaticity Diagram.....	7
Flux Distribution – Zonal Lumen Summary.....	8
Illuminance Plots.....	9
Candela Plots.....	10
Candela Tabulation.....	11
Photometric Testing Information.....	13
Equipment List:.....	14

Sample

The following sample was submitted for evaluation:

MSI SSL – iGU1030321D 3000K 32D



iGU1030321D 3000K 32D

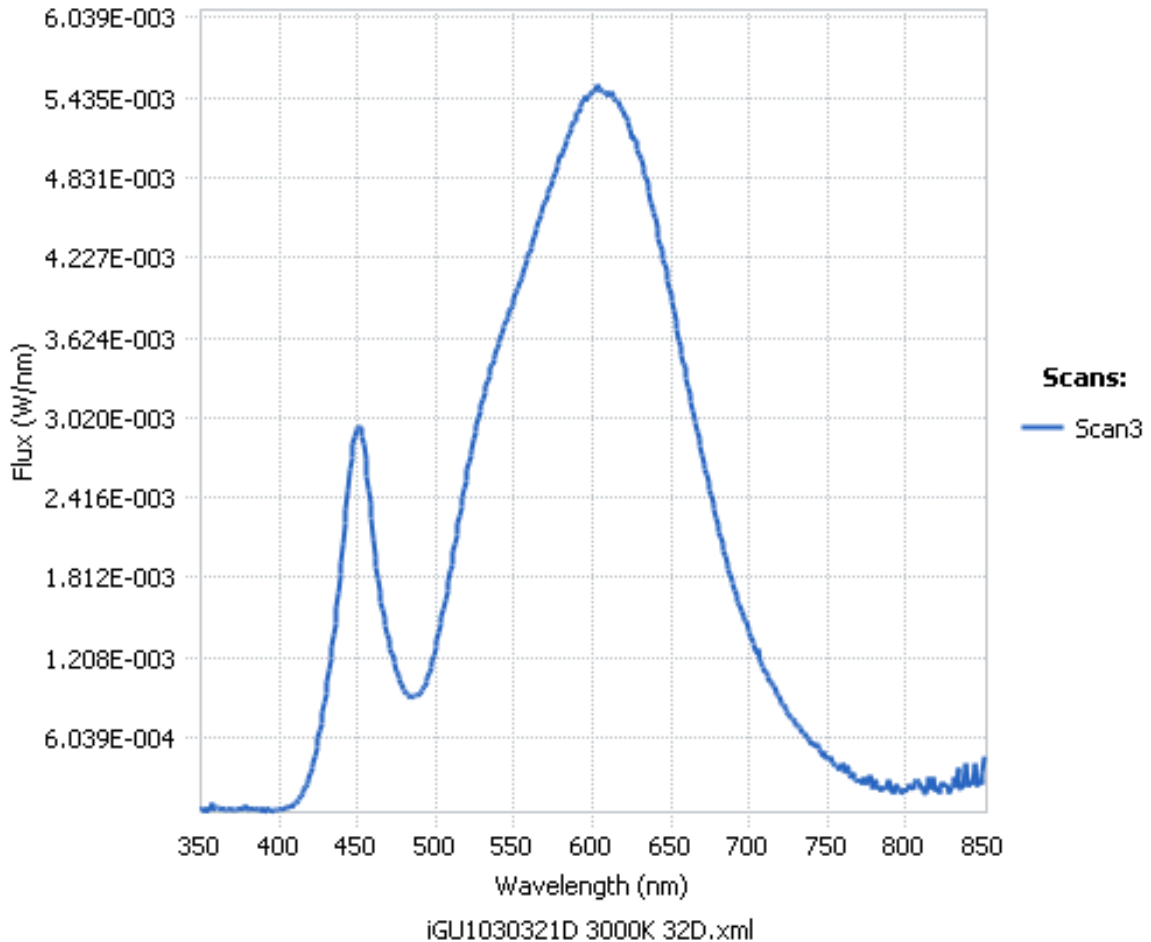


September 9, 2011

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	
	iGU1030321D 3000K 32D	
	Integrating Sphere	Goniophotometer
Luminous Efficacy (Lumens/Watt)	68.72	67.52
Total Luminous Flux (Lumens)	288.3	276.82
Total Radiant Flux (Watts)	0.9515	
Correlated Color Temperature (CCT)	3036.3	
Color Rendering Index (CRI)	81.7	
R9 Value	20.4	
Chromaticity (Chroma x / Chroma y)	0.4323 / 0.3991	
Chromaticity (Chroma u / Chroma v)	0.2497 / 0.3458	
Chromaticity (Chroma u' / Chroma v')	0.2497 / 0.5187	
D _{uv} Value	-0.00135	
Stabilization Time (Light and Power)	Approx. 38 minutes	
Total Run Time – Integrating Sphere	42 minutes	
Total Run Time – Goniophotometer	98 minutes	
Spacing Criteria	0.44 (0° – 180°) / 0.44 (90° – 270°)	
Electrical Input Results:	Sample Reference	
	iGU1030321D 3000K 32D	
	Integrating Sphere	Goniophotometer
Input Power (Watts)	4.195	4.1
Input Voltage (Volts AC)	120.0	120.0
Input Current (Amps)	0.036	0.035
Input Frequency (Hertz)	60.0	60.0
Power Factor	0.967	0.971
Additional Information	Sample Reference	
	iGU1030321D 3000K 32D	
Ambient Temperature	25.7°C	
Integrating Sphere Detector	CDS 600 Spectroradiometer	
Absorption Correction used?	Yes	

Spectral Flux

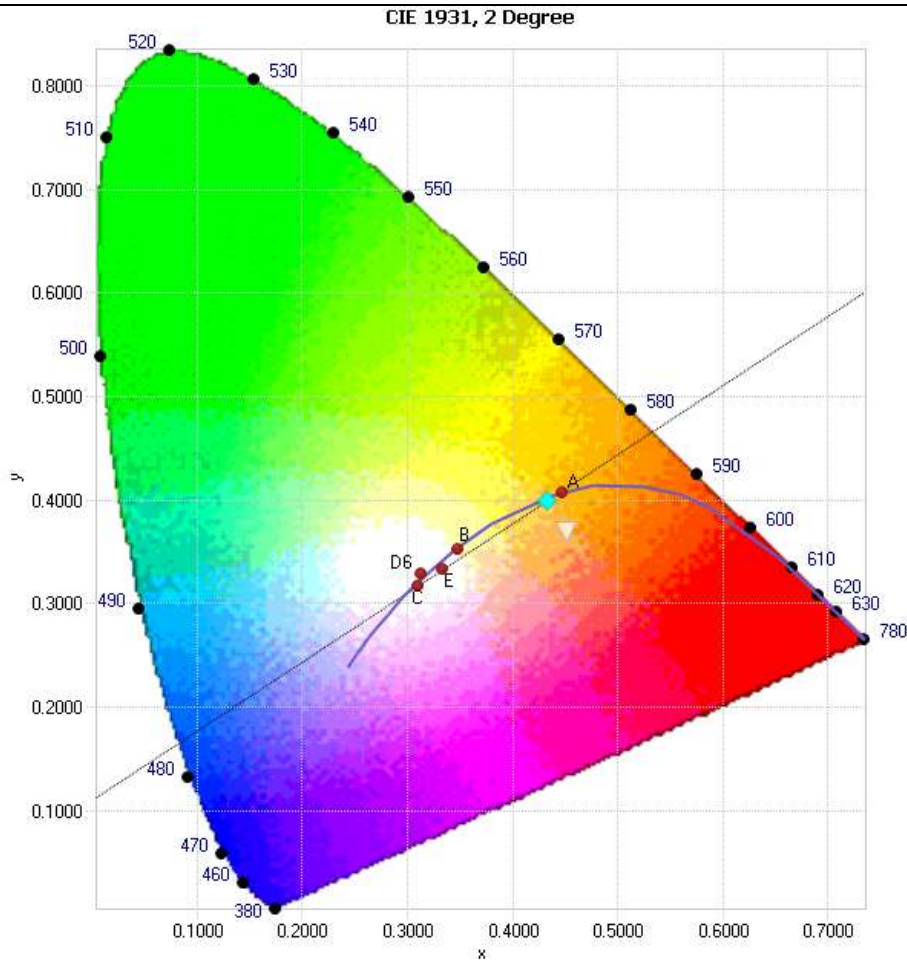
The following graph shows the spectral response curve of the radiant flux for the sample:



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):
 $x / y = 0.4323 / 0.3991$

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



September 9, 2011

Test Results – Flux Distribution – Zonal Lumen Summary

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

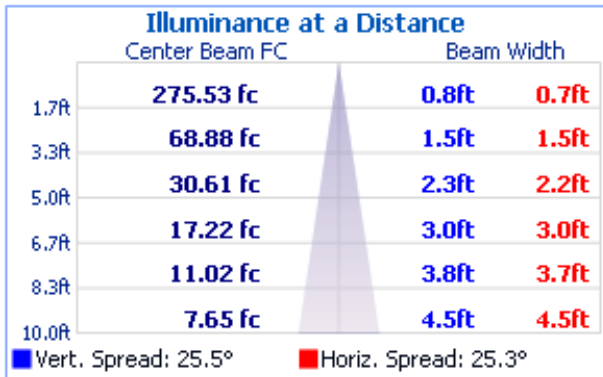
Zone	Lumens	% Total
0 - 10	59.3	21.40%
10 - 20	83.7	30.20%
20 - 30	51.1	18.50%
30 - 40	30.3	10.90%
40 - 50	18.8	6.80%
50 - 60	12.5	4.50%
60 - 70	8.4	3.00%
70 - 80	5.1	1.90%
80 - 90	2.1	0.80%
90 - 100	0.8	0.30%
100 - 110	0.8	0.30%
110 - 120	0.9	0.30%
120 - 130	1.0	0.40%
130 - 140	0.8	0.30%
140 - 150	0.5	0.20%
150 - 160	0.3	0.10%
160 - 170	0.3	0.10%
170 - 180	0.1	0%
Total	276.82 Lumens	100%

Zonal Lumen Summary

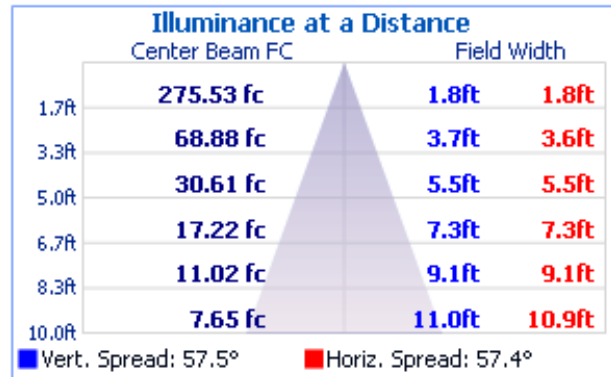
Zone	Lumens	% Lamp / Luminaire
0 - 60	255.7	92.4 %
60 - 90	15.6	5.6 %
0 - 90	271.4	98.0 %
90 - 180	5.5	2.0 %
0 - 180	276.8	100 %

Test Results – Illuminance Plots

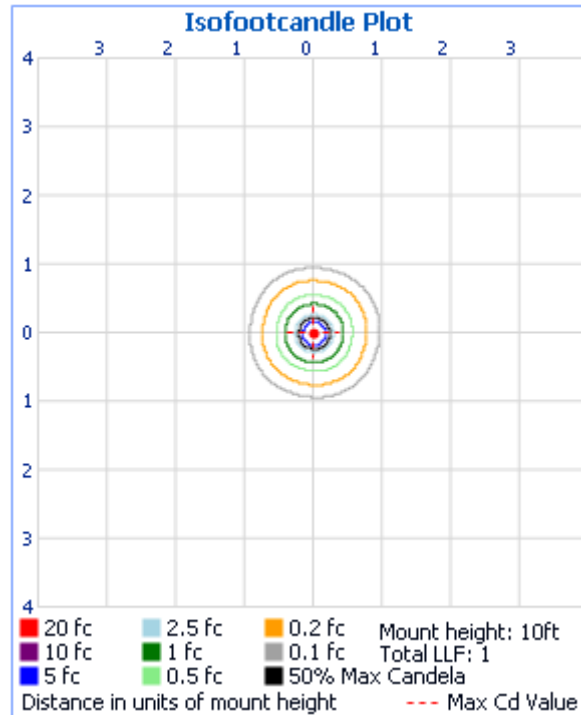
The following images depict the illuminance characteristics of the luminaire.



Beam Angle



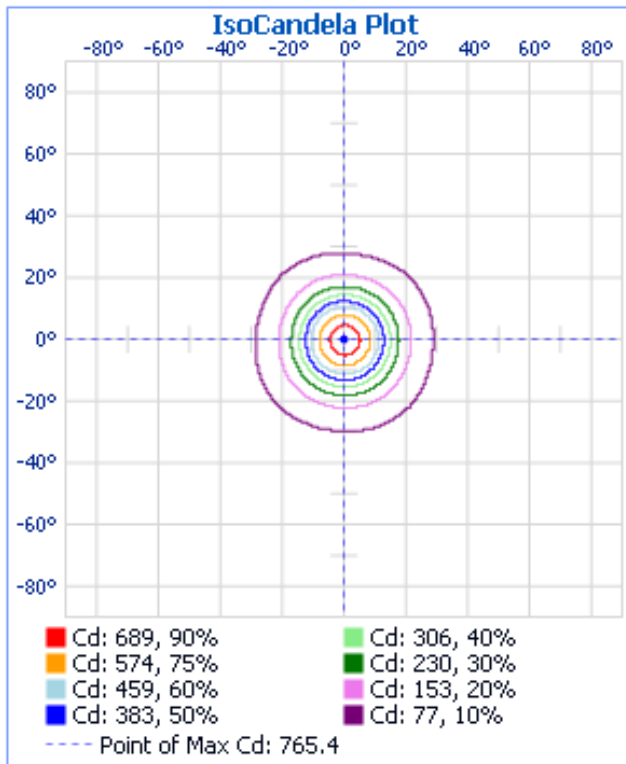
Field Angle



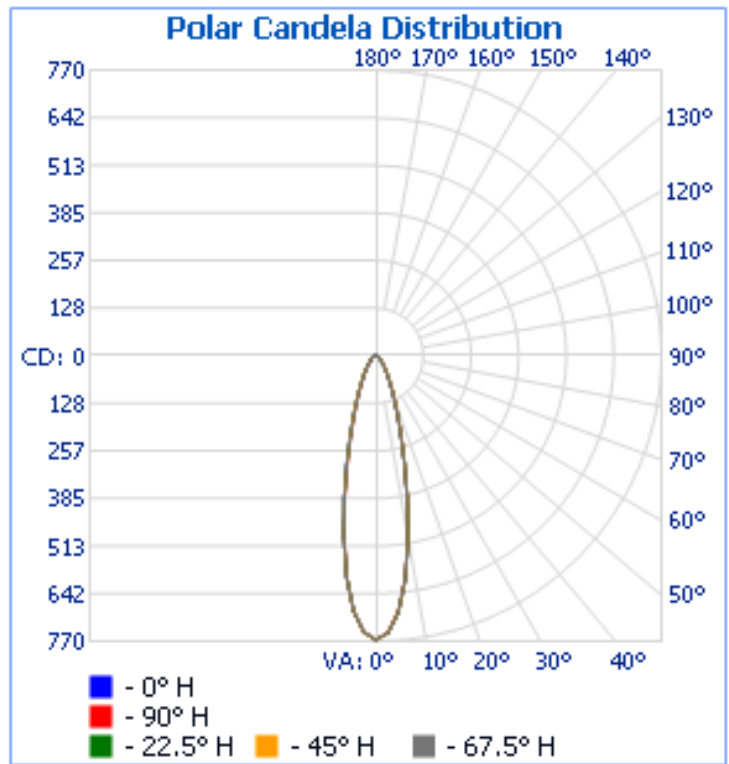
Illuminance Plot (Footcandles)

Test Results – Candela Plots

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



Isocandela Plot



Polar Candela Distribution



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	765	765	765	765	765	765	765	765	765	765	765	765	765	765	765	765	765
2.5	748	748	748	747	746	746	745	745	745	745	745	746	747	747	748	748	748
5.0	695	694	694	692	691	690	690	689	689	689	690	690	691	692	694	694	694
7.5	608	608	607	606	605	604	603	603	603	603	602	602	602	604	606	607	607
10.0	500	501	501	499	498	498	499	499	499	498	497	495	494	496	497	498	499
12.5	390	392	392	390	390	391	393	394	395	393	392	388	386	387	387	386	388
15.0	295	297	298	297	297	300	303	304	305	304	301	297	295	295	294	293	294
17.5	223	226	227	226	226	230	233	233	234	234	231	227	225	225	224	222	222
20.0	170	173	175	173	174	179	181	181	180	182	180	175	172	174	172	169	170
22.5	131	135	137	135	135	141	143	141	141	143	141	136	133	135	134	131	131
25.0	102	107	109	106	107	112	115	112	111	114	112	107	105	107	106	102	102
27.5	81	85	87	85	85	91	93	90	89	92	90	85	83	86	85	81	81
30.0	65	69	71	68	69	74	76	73	72	75	73	68	67	69	69	65	65
32.5	53	57	58	56	56	61	62	60	59	61	60	56	54	57	56	53	53
35.0	43	47	48	46	47	50	52	49	49	51	50	46	45	47	46	43	43
37.5	36	39	40	38	39	42	43	41	40	42	42	38	37	39	38	36	36
40.0	30	33	34	32	33	36	37	34	34	36	35	32	31	32	32	30	30
42.5	26	28	28	27	28	30	31	29	29	30	30	27	26	27	27	26	26
45.0	22	23	24	23	24	26	26	25	25	26	25	23	22	23	23	22	22
47.5	19	20	21	20	20	22	23	22	21	22	22	20	19	20	20	19	19
50.0	17	17	18	18	18	19	20	19	18	19	19	17	17	17	17	17	17
52.5	15	15	16	15	16	17	17	16	16	16	16	15	15	15	15	15	15
55.0	13	14	14	14	14	15	15	14	14	14	14	13	13	13	13	13	13
57.5	12	12	12	12	12	13	13	13	12	13	13	12	12	12	12	11	12
60.0	10	11	11	11	11	11	12	11	11	11	11	10	10	10	10	10	10
62.5	9	10	10	10	10	10	10	10	10	10	10	9	9	9	9	9	9
65.0	8	8	8	8	9	9	9	9	9	9	9	8	8	8	8	8	8
67.5	7	7	7	7	8	8	8	8	8	8	8	7	7	7	7	7	7
70.0	6	6	6	6	7	7	7	7	7	7	7	6	6	6	6	6	6
72.5	6	5	5	6	6	6	6	6	6	6	6	6	6	5	5	5	6
75.0	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
77.5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
80.0	3	3	3	3	3	3	4	4	3	3	3	3	3	3	3	3	3
82.5	3	2	2	2	3	3	3	3	3	3	3	3	3	2	2	2	3
85.0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
87.5	1	1	1	1	1	1	1	2	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

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September 9, 2011



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	1	1	1	1	1	1	1	1
100.0	1	1	1	1	1	1	1	0	0	1	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	1	1	1	1	1	1	1	1
107.5	1	1	1	1	1	1	1	0	0	1	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	1	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	2	1	1	2	1	1	1	0	0	0	1	1	1	1	1	1	2
125.0	2	1	1	2	2	1	1	0	0	0	1	1	1	1	1	1	2
127.5	2	1	1	2	2	1	1	0	0	0	1	1	1	1	1	1	2
130.0	2	1	1	2	2	1	1	0	0	0	1	1	1	1	1	1	2
132.5	1	1	1	2	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	0	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	0	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	0	0	0	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



September 9, 2011

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).

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September 9, 2011

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.