

PHOTOMETRIC TESTING & EVALUATION TO IES LM-79-08

Sample Tested
Circular 8 inch

Prepared for:


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**Technical Report Number
2744065-03**

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Program Description

Photometric and electrical testing of a “Circular 8 inch” fixture to IES LM-79-08.

Executive Summary

Sample Tested = **Circular 8 inch**

Luminous Efficacy* (Lumens/Watt)	Luminous Flux* (Lumens)	Input Power* (Watts)	Power Factor*
64.25	2294	35.703	0.9725

CCT (K)*	CRI*	Stabilization Time (Light & Power)
2980	82.4	60 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:

3form: Circular 8 inch

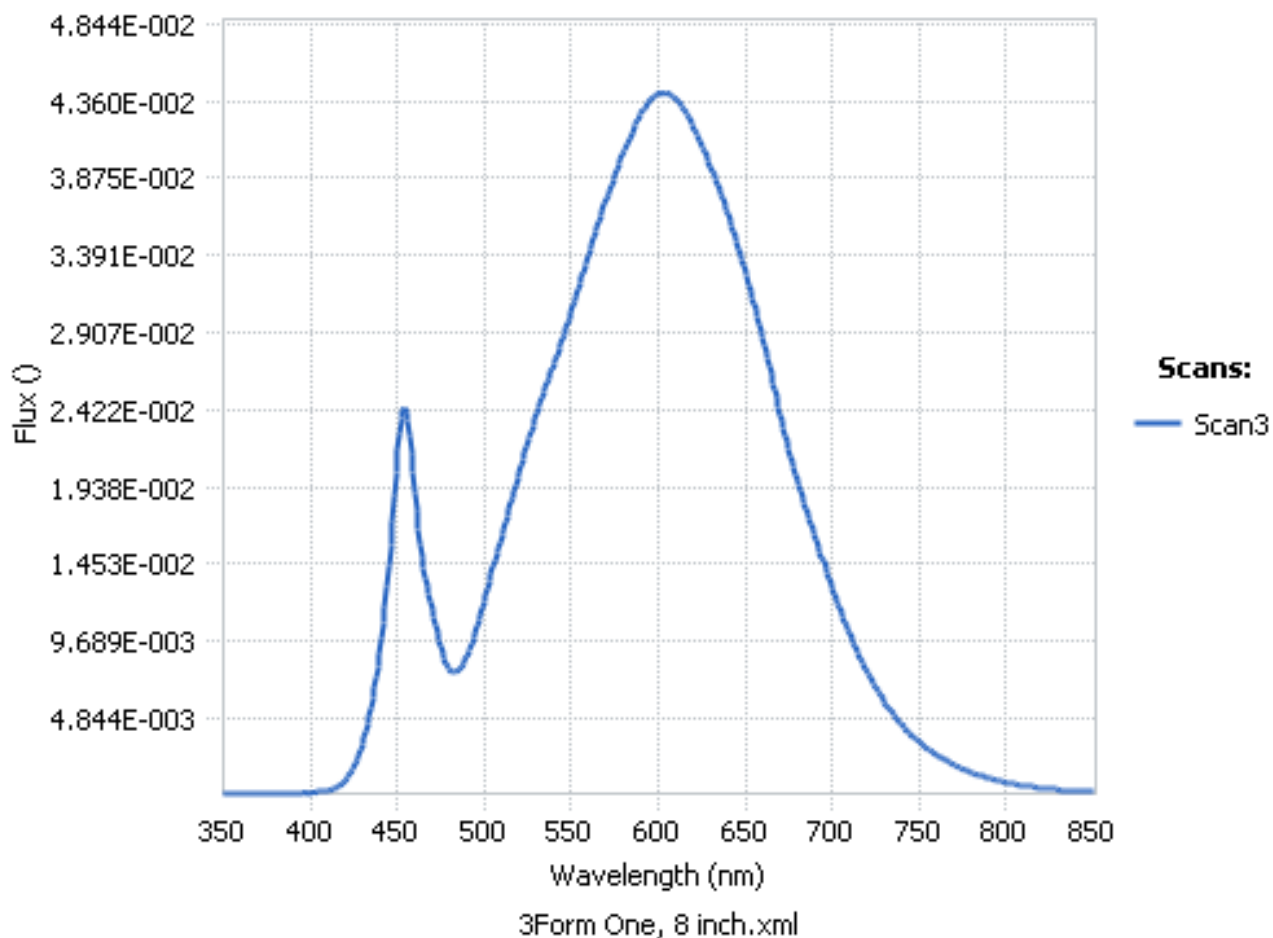


Circular 8 inch

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							
	Circular 8 inch							
	Integrating Sphere				Goniophotometer			
Luminous Efficacy (Lumens/Watt)	64.25				62.74			
Total Luminous Flux (Lumens)	2294				2240.11			
Total Radiant Flux (Watts)	7.505							
Correlated Color Temperature (CCT)	2980							
Color Rendering Index (CRI) (Ra)	82.4							
R1 thru R7 Value	80.3	88.9	95.4	79.3	79.1	84.1	86.4	
R8 thru R14 Value	65.4	20.4	73.3	75.7	62.1	81.9	97.1	
Chromaticity (Chroma x / Chroma y)	0.4395 / 0.4072							
Chromaticity (Chroma u / Chroma v)	0.2509 / 0.3487							
Chromaticity (Chroma u' / Chroma v')	0.2509 / 0.5230							
Duv Value	0.00089							
Stabilization Time (Light and Power)	Approx. 60 minutes							
Total Run Time – Integrating Sphere	64 minutes							
Total Run Time – Goniophotometer	52 minutes							
Spacing Criteria	1.32 (0° – 180°) / 1.32 (90° – 270°)							
Scotopic/Photopic ratio $\Phi(v')/\Phi(v)$	1.296							
Electrical Input Results:	Sample Reference							
	Circular 8 inch							
Input Power (Watts)	35.703							
Input Voltage (Volts AC)	120.03							
Input Current (Amps)	0.30586							
Input Frequency (Hertz)	60							
Power Factor	0.9725							
Total Harmonic Distortion (%THD V/A)	0.09 / 9.80							
Additional Information	Sample Reference							
	Circular 8 inch							
Ambient Temperature	24.6°C							
Integrating Sphere Detector	CDS 1100 Spectroradiometer							
Absorption Correction used?	Yes							

Spectral Flux

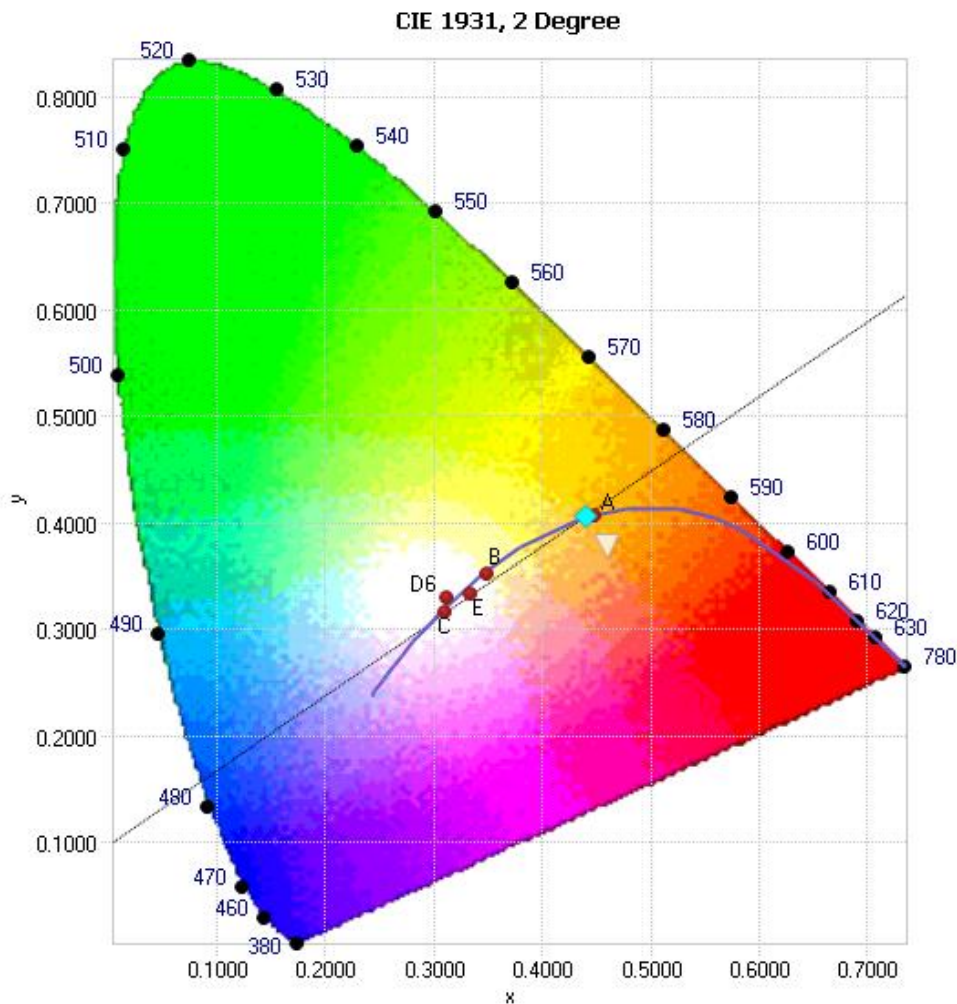
The following graph shows the spectral response curve of the radiant flux for the sample:



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 = 0.4395 / 0.4072

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

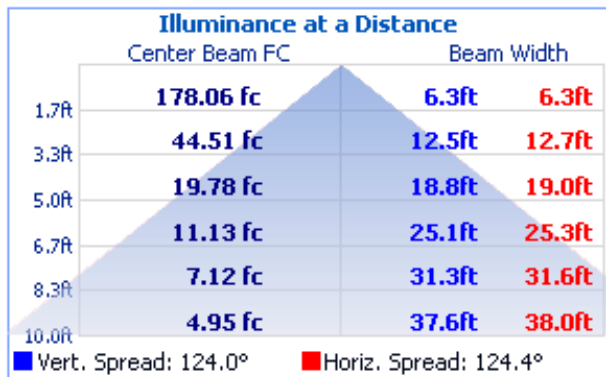
Test Results – Flux Distribution – Zonal Lumen Summary

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

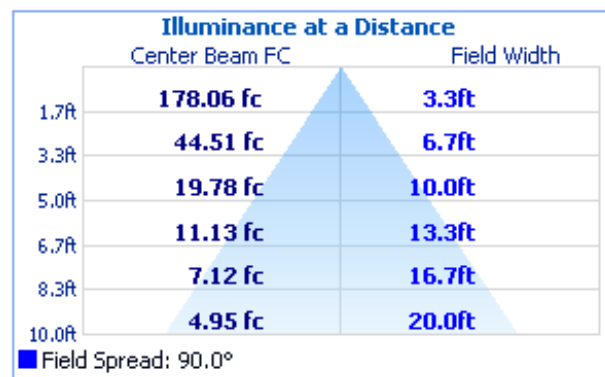
Zone	Lumens	% Total
0 - 10	47	2.10%
10 - 20	136.8	6.10%
20 - 30	211.1	9.40%
30 - 40	260.5	11.60%
40 - 50	279.3	12.50%
50 - 60	266.4	11.90%
60 - 70	225.1	10.00%
70 - 80	163.2	7.30%
80 - 90	94.9	4.20%
90-100	77.8	3.50%
100-110	85.5	3.80%
110-120	88.5	4%
120-130	84.6	3.80%
130-140	74.1	3.30%
140-150	59.9	2.70%
150-160	46.1	2.10%
160-170	29.4	1.30%
170-180	9.8	0.40%
Total	2240.1 LUMENS	100.0%
Zone		
0-60	1,201.20	53.60%
60-90	483.2	21.60%
0-90	1,684.40	75.20%
90-180	555.7	24.80%
0-180	2,240.10	100%

Test Results – Illuminance Plots

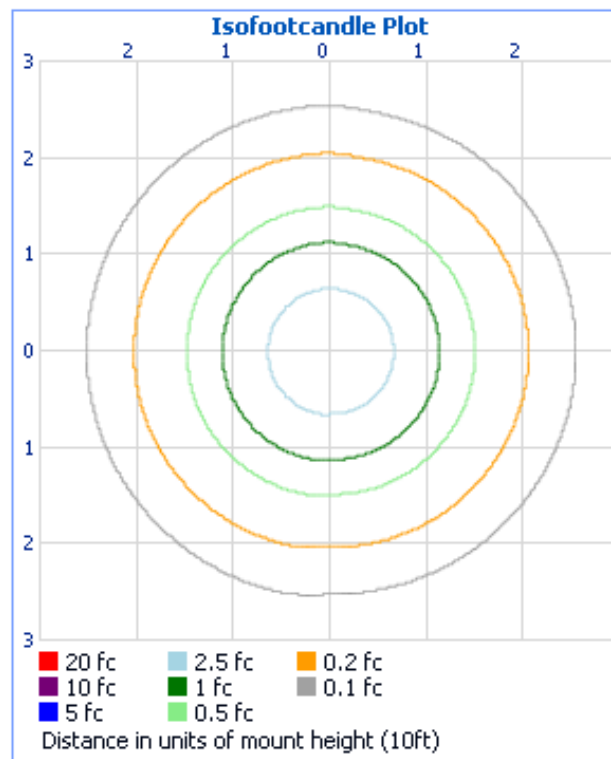
The following images depict the illuminance characteristics of the luminaire.



Beam Angle



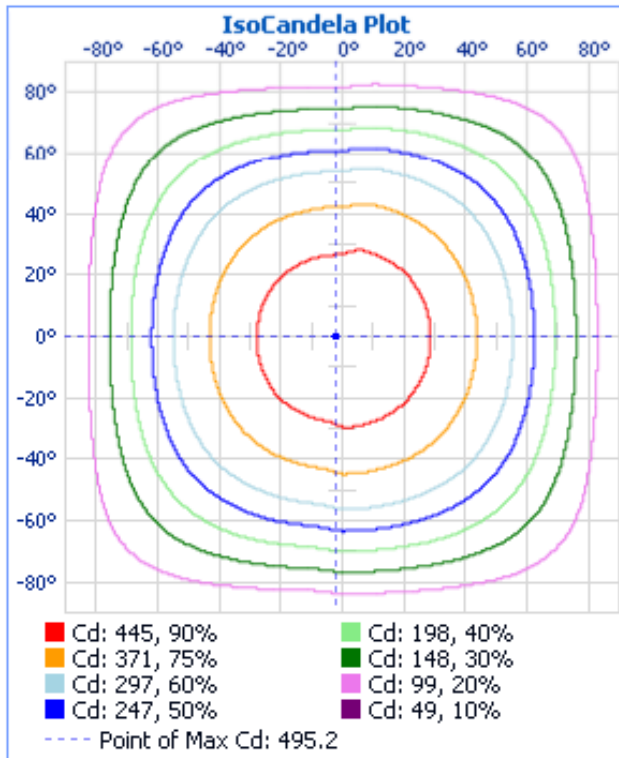
Field Angle



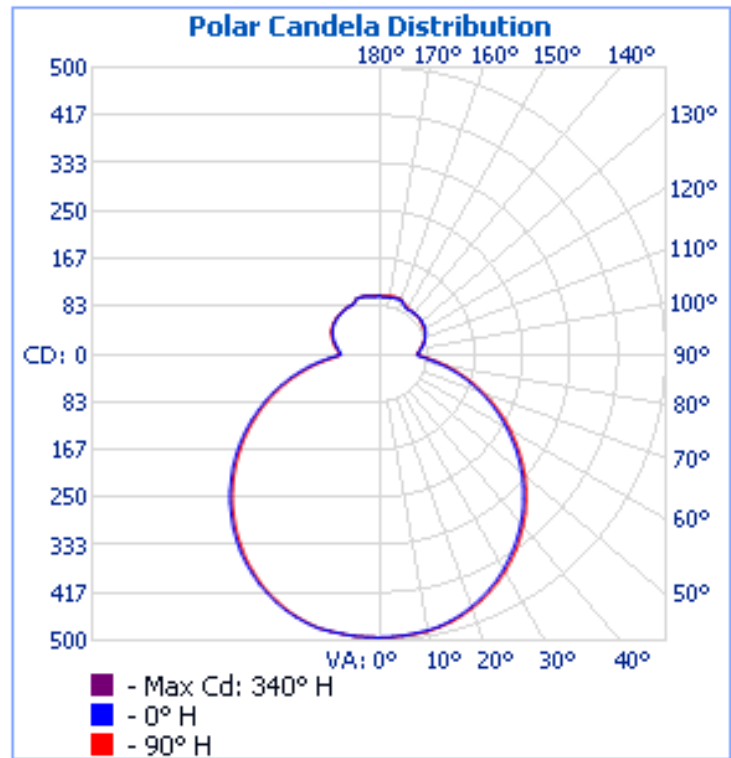
Illuminance Plot (Footcandles)

Test Results – Candela Plots

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



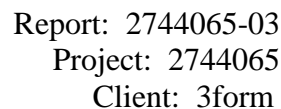
Isocandela Plot



Polar Candela Distribution

Coefficients Of Utilization - Zonal Cavity Method

		Effective Floor Cavity Reflectance: 20%																				
RCC %:		80				70				50				30				10				0
RW %:		70	50	30	0	70	50	30	0	50	30	20	0	50	30	20	0	50	30	20	0	
RCR: 0		1.13	1.13	1.13	1.13	1.08	1.08	1.08	.75	.97	.97	.97	.88	.88	.88	.79	.79	.79	.79	.75		
1		1.02	.96	.92	.87	.96	.92	.87	.60	.83	.80	.77	.75	.72	.70	.67	.65	.63	.60	.60		
2		.92	.83	.76	.70	.87	.79	.73	.50	.72	.66	.62	.65	.60	.57	.58	.55	.52	.48	.48		
3		.83	.72	.64	.57	.79	.69	.61	.42	.62	.56	.51	.56	.51	.47	.51	.47	.43	.40	.34		
4		.76	.64	.55	.48	.72	.61	.53	.35	.55	.48	.43	.50	.44	.40	.45	.41	.37	.34	.29		
5		.70	.57	.48	.41	.66	.54	.46	.30	.49	.42	.37	.45	.39	.34	.40	.36	.32	.29	.25		
6		.64	.51	.42	.35	.61	.49	.40	.27	.44	.37	.32	.40	.34	.30	.36	.32	.28	.25	.22		
7		.59	.46	.37	.31	.56	.44	.36	.24	.40	.33	.28	.37	.31	.26	.33	.28	.24	.22	.20		
8		.55	.42	.33	.27	.52	.40	.32	.21	.37	.30	.25	.33	.28	.23	.30	.25	.22	.20	.18		
9		.51	.38	.30	.24	.49	.36	.29	.19	.34	.27	.22	.31	.25	.21	.28	.23	.20	.18	.16		
10		.48	.35	.27	.22	.46	.34	.26	.17	.31	.25	.20	.28	.23	.19	.26	.21	.18	.16	.14		



The following table provides the tabulated Candela measurements:

	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350	360			
0	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495		
2.5	494	494	494	494	494	494	495	494	494	495	494	495	495	494	494	494	495	494	494	495	494	494	494	494	494	495	495	495	494	495	495	495	495	495	494	495	494	495	495	
5	493	493	494	494	494	493	494	494	494	493	494	494	493	494	494	493	494	494	494	494	493	493	493	493	494	494	494	494	494	494	494	494	495	494	494	494	494	495	495	
7.5	491	491	492	492	492	493	492	492	492	493	492	493	493	493	492	492	492	492	493	493	493	493	493	493	492	493	492	492	493	493	493	493	493	493	493	493	493	493	493	491
10	490	490	489	490	490	491	491	491	491	491	491	491	490	491	491	491	490	491	490	491	492	491	492	491	492	491	492	492	492	491	492	492	491	492	492	492	492	492	490	
12.5	487	487	487	487	488	487	488	488	489	488	488	489	488	488	489	488	488	488	488	490	490	489	489	488	489	489	489	489	489	489	489	489	489	489	489	489	490	489	487	
15	482	482	482	483	483	484	484	484	484	485	484	484	485	484	484	483	483	486	486	486	486	486	486	486	486	486	485	485	485	485	485	484	485	486	486	486	486	486	482	
17.5	476	477	476	477	478	478	479	479	479	479	479	480	479	478	479	479	479	478	481	481	481	481	480	480	480	480	480	480	480	480	480	480	480	481	481	481	481	481	476	
20	469	470	471	471	472	472	473	473	473	473	473	473	473	473	471	472	471	476	475	474	474	474	474	474	474	474	474	474	473	473	473	473	474	474	474	475	475	475	469	
22.5	462	463	463	464	464	465	465	465	465	466	466	466	466	466	465	465	464	464	469	468	468	468	468	468	466	466	466	466	466	466	466	466	466	467	468	467	468	469	466	
25	453	454	455	459	456	456	457	458	458	458	458	458	457	458	457	456	456	456	461	461	460	460	459	459	459	459	458	459	458	458	458	459	459	459	459	460	460	461	453	
27.5	444	444	446	446	447	448	448	448	448	449	448	448	449	450	448	447	447	446	453	452	451	451	450	450	449	449	449	449	449											

150	93	93	92	92	93	93	92	93	93	96	92	92	93	94	93	93	93	93	98	98	98	97	97	97	98	98	98	98	98	98	97	97	97	97	98	98	93
152.5	95	94	95	95	95	95	94	94	98	94	95	95	96	96	96	95	95	98	98	99	99	99	99	99	99	98	98	98	98	99	99	99	98	98	98	98	95
155	98	98	99	99	99	99	99	99	99	98	98	99	99	99	100	100	100	100	101	101	101	102	102	102	102	101	101	101	101	101	102	101	101	101	101	100	98
157.5	101	101	101	101	101	102	103	103	103	102	102	102	102	101	101	102	102	103	104	104	104	105	105	105	104	104	104	104	104	104	104	104	104	105	104	105	101
160	101	101	101	101	102	103	105	105	105	104	103	102	102	102	102	102	103	103	104	105	106	106	106	106	106	104	104	104	104	104	105	105	106	106	106	106	101
162.5	101	101	101	101	102	103	104	105	105	103	103	102	102	102	102	102	103	104	104	105	106	107	107	106	106	104	104	104	104	104	105	105	106	107	107	106	101
165	101	101	101	101	102	104	105	105	104	104	103	102	102	101	102	102	103	104	104	104	106	107	107	106	105	105	104	104	104	104	104	105	106	107	107	106	101
167.5	101	100	101	102	103	104	104	105	104	103	102	102	101	101	101	102	103	104	103	104	105	106	106	105	105	105	104	104	103	103	103	104	105	106	106	105	101
170	100	100	101	102	103	104	104	104	103	103	102	101	101	101	101	102	103	104	102	103	104	105	105	105	104	104	104	103	102	102	103	104	105	106	105	105	100
172.5	100	100	101	102	103	104	104	104	103	102	102	101	101	101	101	102	104	104	101	102	104	105	105	105	104	104	104	103	102	101	102	103	104	105	105	104	100
175	100	100	101	102	103	104	104	104	103	102	101	101	101	101	101	102	104	104	100	102	102	104	104	104	103	103	103	102	101	101	101	102	103	104	104	104	100
177.5	100	100	101	102	103	104	104	103	102	102	101	101	100	101	102	103	103	104	100	101	102	103	104	104	103	103	102	102	101	101	101	101	102	104	104	104	100
180	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102	102

Continued.....

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 by Labsphere 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.

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. 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 Voltage 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 Mayer Engineering Type C is calibrated using a frosted tungsten filament FDS/DZE lamp with the following specifications:

Manufacturer: GE
Part Number: DZE 88
Bulb Number: 114-A
Voltage: 16.59 Volts DC reference
Calibration Current: 4.810 Amperes
Luminous Intensity: 154.7 Candelas
Calibration Date: 7/12/12 (NIST traceable)

Manufacturer: GE
Part Number: DZE 88
Bulb Number: 114-B
Voltage: 16.61 Volts DC reference
Calibration Current: 4.819 Amperes
Luminous Intensity: 150.6 Candelas
Calibration Date: 7/12/12(NIST traceable)

Manufacturer: GE
Part Number: DZE 88
Bulb Number: 114-C
Voltage: 16.66 Volts DC reference
Calibration Current: 4.815 Amperes
Luminous Intensity: 155.4 Candelas
Calibration Date: 7/12/12 (NIST traceable)

A Yokogawa WT210 Power Analyzer was used to measure all electrical characteristics of the sample.

CSA is an accredited Test Laboratory
National Voluntary Laboratory Accreditation Program
(NVLAP)200732-0

Equipment List: Goniophotometer Type C (Mirror 1)			
Description	Manufacturer and Model Number	CSA Instrument Reference Number	Calibration Due Date
Optometer	Gigahertz Optik P9801	N/A	N/A
Regulated Power Supply	Chroma Instruments 61602P-80-60	DCP401	N/A
Regulated Power Supply	Chroma Instruments 61602	DCP301	N/A
Power Analyzer	Yokogawa WT210	POA400	11/2014
Equipment List: Sphere B Equipment			
Description	Manufacturer and Model Number	CSA Instrument Reference Number	Calibration Due Date
Integrating Sphere 76"	Labsphere LMS760	SPH200	N/A
Spectroradiometer	Labsphere CDS600	CDS600B	N/A
Auxiliary Lamp PSU	Labsphere LPS100	LPS100	N/A
Power Analyzer	Yokogawa WT210	PA112	2/2015
Regulated Power Supply	Chroma Instruments 61603	AC303	N/A

All equipment is calibrated to ISO / IEC 17025-2005 guidelines.