



## PHOTOMETRIC TESTING & EVALUATION TO IES LM-79-08

Sample Tested  
**LST**

Prepared for:

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**Technical Report  
Number 70037983**

July 1, 2015

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## Program Description

Photometric and electrical testing of a “LST” Post Style Luminaire to IES LM-79-08.

## Executive Summary

Sample Tested = LST

Luminous Efficacy* (Lumens/Watt)	Luminous Flux* (Lumens)	Input Power* (Watts)	Power Factor*
78.40	21,930	279.69	0.9944

CCT (K)*	CRI*	Stabilization Time (Light & Power)
4542	76.13	60 minutes

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

Roadway Summary <sup>‡</sup> - Utilization		
Downward Utilization		Percentage of Luminaire
Downward Street Side:	16,349.5	74.8%
Downward House Side:	5,502.0	25.2%
Downward Total:	21,851.5	100%
Total Lumens:	21,851.5	100%
IES Classification		Type II, Short

<sup>‡</sup> Based upon IES file generated output – Total Lumens may differ from Integrating Sphere results. Gonio-Photometric calculations based upon a mount height of 30ft.

**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 ..... **Error! Bookmark not defined.**

BUG Rating Analysis ..... 12

Photometric Testing Information ..... 13

Equipment List:..... 15

**Sample**

The following sample was submitted for evaluation:

**Global Green Lighting: LST**



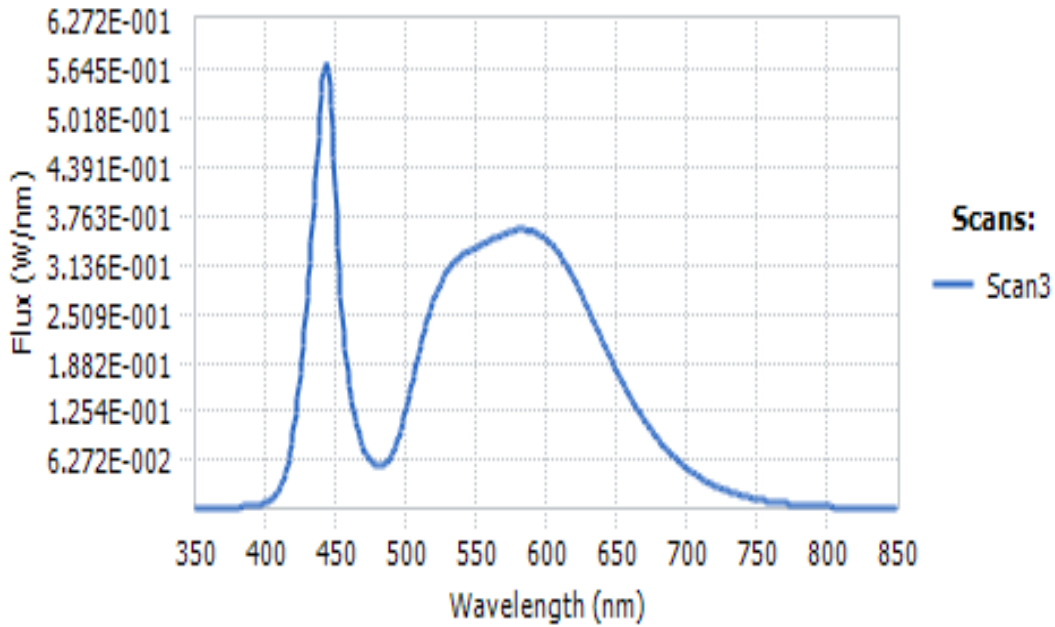
**LST ROADWAY (STREET LAMP)**



<b>Test Results –</b>		
The following results were measured after stabilization of the sample in the <b>Integrating Sphere</b> (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).		
<b>Key Photometric Results</b>	<b>Sample Reference</b>	
	<b>LST STREET LAMP</b>	
	<b>Integrating Sphere</b>	<b>Goniophotometer</b>
Luminous Efficacy (Lumens/Watt)	<b>78.40</b>	<b>78.12</b>
Total Luminous Flux (Lumens)	<b>21930</b>	<b>21850.54</b>
Total Radiant Flux (Watts)	<b>69.66</b>	
Correlated Color Temperature (CCT)	<b>4542</b>	
Color Rendering Index (CRI) (Ra)	<b>76.13</b>	
R9 Value	<b>5.3</b>	
Chromaticity (Chroma x / Chroma y)	<b>0.3573 / 0.3510</b>	
Chromaticity (Chroma u / Chroma v)	<b>0.2200 / 0.3241</b>	
Chromaticity (Chroma u' / Chroma v')	<b>0.2200 / 0.4862</b>	
D <sub>uv</sub> Value	<b>0.0056</b>	
Stabilization Time (Light and Power)	<b>Approx. 60 minutes</b>	
Total Run Time – Integrating Sphere	<b>64 minutes</b>	
Total Run Time – Goniophotometer	<b>61 minutes</b>	
Spacing Criteria	<b>2.60 (0° – 180°) / 2.10 (90° – 270°)</b>	
Scotopic/Photopic ratio $\Phi(v')/\Phi(v)$	<b>1.66</b>	
<b>Electrical Input Results:</b>	<b>Sample Reference</b>	
	<b>LST STREET LAMP</b>	
Input Power (Watts)	<b>279.69</b>	
Input Voltage (Volts AC)	<b>120.02</b>	
Input Current (Amps)	<b>2.3435</b>	
Input Frequency (Hertz)	<b>60</b>	
Power Factor	<b>0.9944</b>	
Total Harmonic Distortion (THD V/A) %	<b>0.15 / 5.71</b>	
<b>Additional Information</b>	<b>Sample Reference</b>	
	<b>LST STREET LAMP</b>	
Ambient Temperature	<b>24.6C</b>	
Integrating Sphere Detector	<b>CDS 1100 Spectroradiometer</b>	
Absorption Correction used?	<b>Yes</b>	

**Spectral Flux**

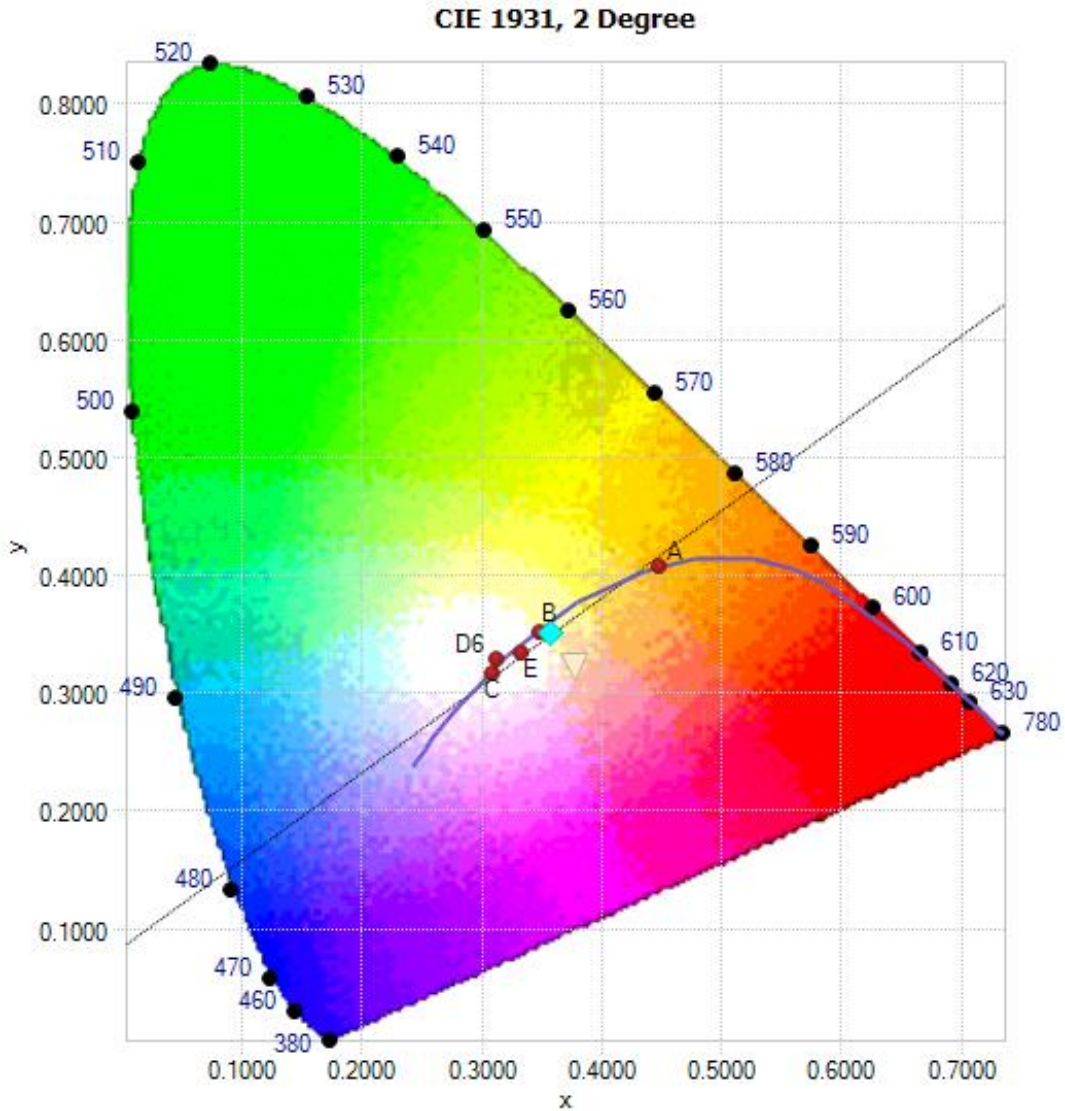
The following graph shows the spectral response curve of the radiant flux for the sample:



**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 5):**  
 $x / y = 0.3573 / 0.3510$

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:

<b>Zone</b>	<b>Lumens</b>	<b>% Total</b>
<b>0-10</b>	<b>447.3</b>	<b>2.0%</b>
<b>10-20</b>	<b>1,283.3</b>	<b>5.9%</b>
<b>20-30</b>	<b>2,274.4</b>	<b>10.4%</b>
<b>30-40</b>	<b>3,350.8</b>	<b>15.3%</b>
<b>40-50</b>	<b>4,464.1</b>	<b>20.4%</b>
<b>50-60</b>	<b>4,945.9</b>	<b>22.6%</b>
<b>60-70</b>	<b>3,488.4</b>	<b>16.0%</b>
<b>70-80</b>	<b>1,259.0</b>	<b>5.8%</b>
<b>80-90</b>	<b>338.3</b>	<b>1.5%</b>
<b>Total</b>	<b>21851.5 Lumens</b>	<b>100%</b>

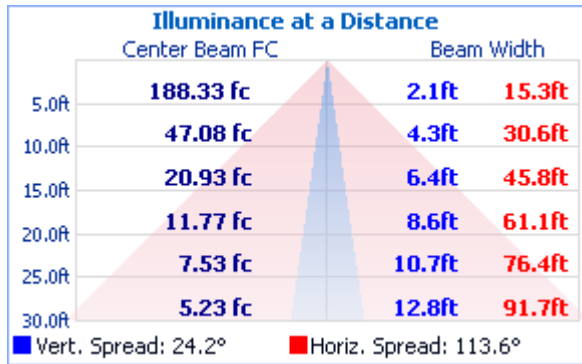
**Zonal Lumen Summary**

<b>Zone</b>	<b>Lumens</b>	<b>% Lamp / Luminaire</b>
<b>0-30</b>	<b>4,005.0</b>	<b>18.3%</b>
<b>0-40</b>	<b>7,355.8</b>	<b>33.7%</b>
<b>0-60</b>	<b>16,765.8</b>	<b>76.7%</b>
<b>60-90</b>	<b>5,085.7</b>	<b>23.3%</b>
<b>0-90</b>	<b>21,851.5</b>	<b>100%</b>

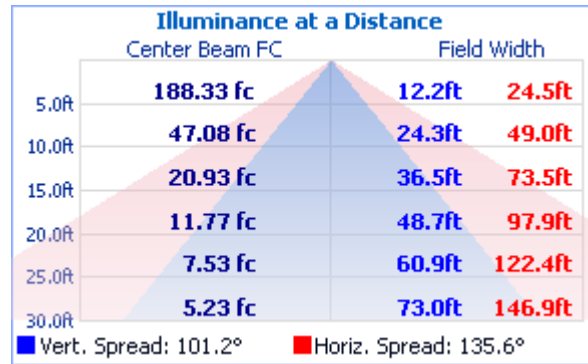


**Test Results – Illuminance Plots**

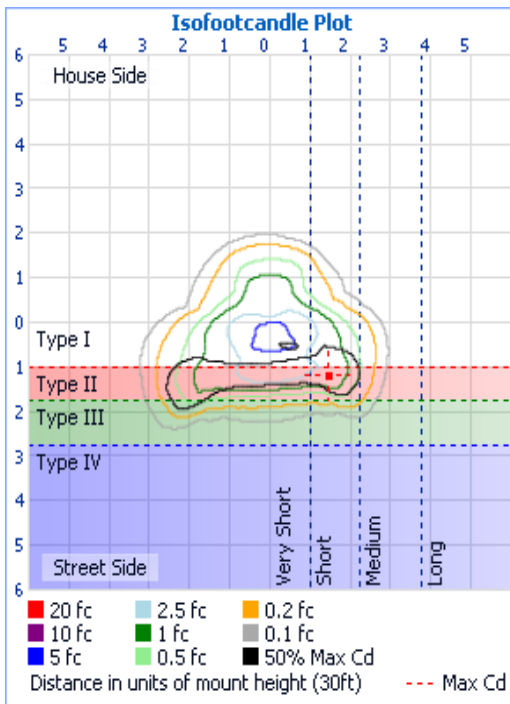
The following images depict the illuminance characteristics of the luminaire.



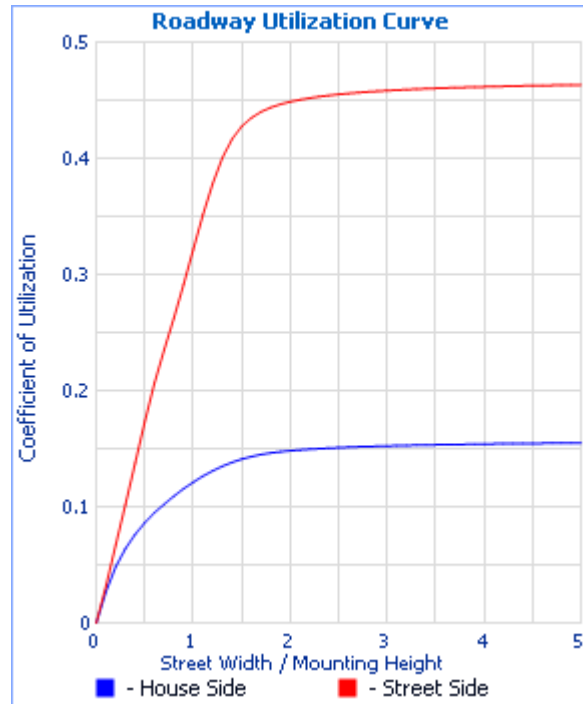
Beam Angle



Field Angle



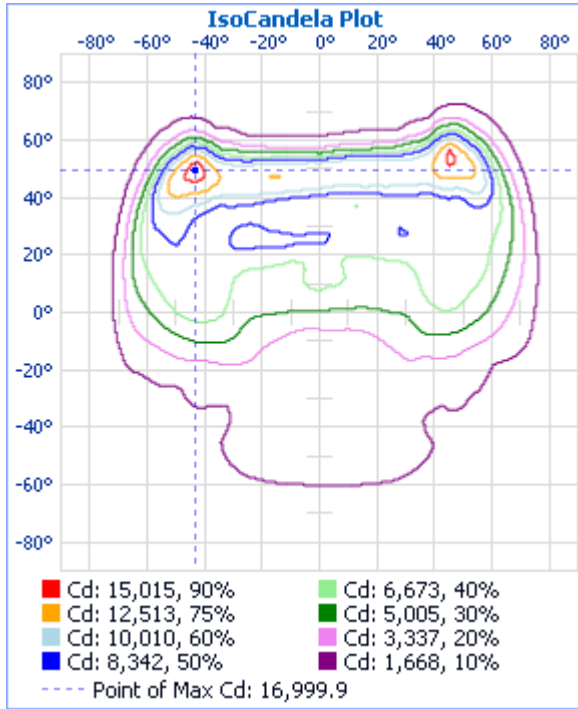
Illuminance Plot (Footcandles)



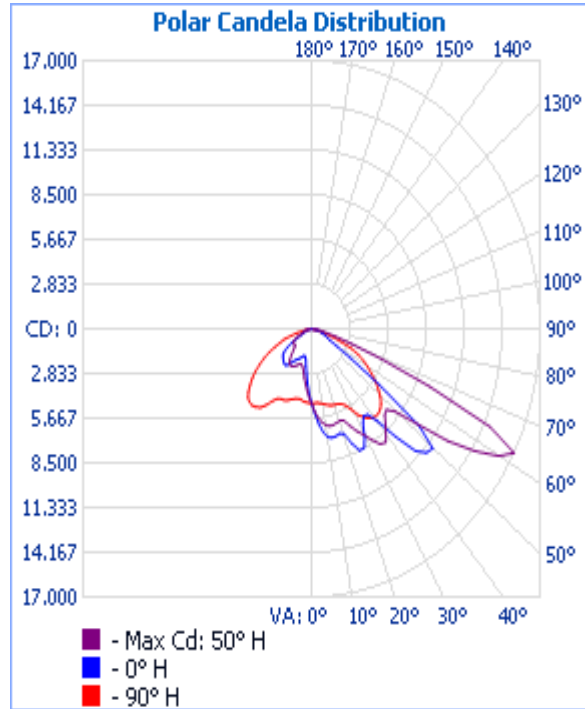
Roadway Utilization Curve

**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
	70	50	30	0	70	50	30	0	50	30	20	50	30	20	50	30	20	50	30	20	0
RW %:	1.19	1.19	1.19	1.19	1.16	1.16	1.16	1.00	1.11	1.11	1.11	1.06	1.06	1.06	1.02	1.02	1.02	1.02	1.02	1.02	1.00
RCR: 0	1.08	1.03	.99	.95	1.05	1.01	.97	.84	.97	.93	.90	.93	.90	.87	.89	.87	.85	.89	.87	.85	.83
1	.98	.89	.81	.75	.95	.87	.80	.69	.83	.78	.73	.80	.75	.71	.77	.73	.69	.77	.73	.69	.67
2	.88	.77	.68	.61	.85	.75	.67	.57	.72	.65	.59	.69	.63	.58	.67	.61	.57	.67	.61	.57	.55
3	.80	.67	.57	.50	.77	.65	.57	.47	.63	.55	.49	.60	.54	.48	.58	.52	.48	.58	.52	.48	.45
4	.72	.59	.49	.42	.70	.57	.48	.40	.55	.47	.41	.53	.46	.41	.51	.45	.40	.51	.45	.40	.38
5	.66	.52	.42	.36	.64	.51	.42	.34	.49	.41	.35	.47	.40	.35	.46	.39	.34	.46	.39	.34	.32
6	.61	.47	.37	.31	.59	.46	.37	.30	.44	.36	.30	.43	.35	.30	.41	.35	.30	.41	.35	.30	.28
7	.56	.42	.33	.27	.55	.41	.33	.26	.40	.32	.26	.39	.31	.26	.37	.31	.26	.37	.31	.26	.24
8	.52	.38	.29	.23	.51	.37	.29	.23	.36	.29	.23	.35	.28	.23	.34	.28	.23	.34	.28	.23	.21
9	.49	.35	.26	.21	.47	.34	.26	.20	.33	.26	.21	.32	.25	.21	.31	.25	.20	.31	.25	.20	.19
10																					



Candela Table - Type C

Table with 37 columns (0-36) and 90 rows (0-89) containing numerical candela data. Values range from approximately 146 to 9372, with some cells highlighted in blue.



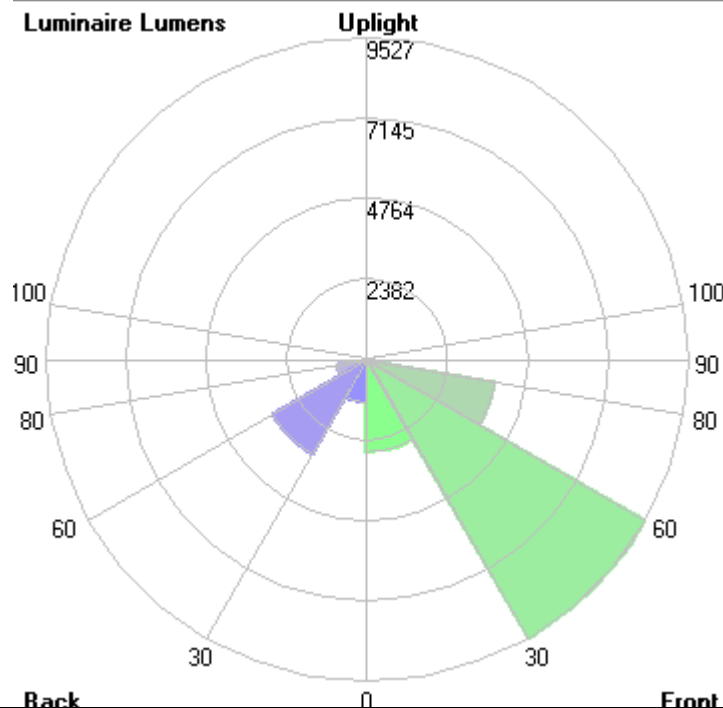
**BUG Rating Analysis**

The following table shows the BUG rating classification:

**Luminaire Classification System (LCS)**

LCS	Zone	Lumens	% of Luminaire
FL	(0-30)	2730.5	12.5
FM	(30-60)	9527.2	43.6
FH	(60-80)	3864.3	17.7
FVH	(80-90)	227	1
BL	(0-30)	1273.9	5.8
BM	(30-60)	3233.2	14.8
BH	(60-80)	884.9	4
BVH	(80-90)	111.4	0.5
UL	(90-100)	11.6	0.1
UH	(100-180)	0	0
<b>Total</b>		<b>21864</b>	<b>100</b>

**BUG RATING = B3-U2-G3**



**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 1<sup>st</sup> 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:

Sphere D	Sphere B & C
Manufacturer: Sylvania	Sylvania
Model# 75Q/CL-28V	796
Voltage = 28.0 Volt	12.0 Volt
Wattage = 75.0 Watts	32.0 Watts
Calibration Current = 2.679 Amperes	2.600Amperes
Luminous Flux = 1538.8 Lumens	554.0 Lumens
Calibration Date = 8-18-2005	11-13-2013
(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



<b>Equipment List: Goniophotometer Type C (Mirror 1)</b>			
<b>Description</b>	<b>Manufacturer and Model Number</b>	<b>CSA Instrument Reference Number</b>	<b>Calibration Due Date</b>
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	11/2015
<b>Equipment List: Sphere B Equipment</b>			
<b>Description</b>	<b>Manufacturer and Model Number</b>	<b>CSA Instrument Reference Number</b>	<b>Calibration Due Date</b>
Integrating Sphere 76"	Labsphere LMS760	SPH200	N/A
Spectroradiometer	Labsphere CDS1100	CDS1100A	N/A
Auxiliary Lamp PSU	Labsphere LPS100	LPS100	N/A
Power Analyzer	Yokogawa WT210	PA112	2/2016
Regulated Power Supply	Chroma Instruments 61603	AC303	N/A

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