

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

Sample Tested  
**BS730LED36WWT35120-277VXXX**

Prepared for:


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**Technical Report Number  
2701077-02**

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## Program Description

Photometric and electrical testing of a “**BS730LED36WWT35120-277VXXX**” replacement luminaire to IES LM-79-08.

## Executive Summary

Sample Tested = **BS730LED36WWT35120-277VXXX**

**Sample #1**

<b>Luminous Efficacy*</b> <b>(Lumens/Watt)</b>	<b>Luminous Flux*</b> <b>(Lumens)</b>	<b>Input Power*</b> <b>(Watts)</b>	<b>Power Factor*</b>
<b>57.30</b>	<b>2056</b>	<b>35.88</b>	<b>0.960</b>

<b>CCT (K)*</b>	<b>CRI*</b>	<b>Stabilization Time (Light &amp; Power)</b>
<b>3493</b>	<b>82.1</b>	<b>45 minutes</b>

\* 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:

**Beghelli North America: BS730LED36WWT35120-277VXXX**

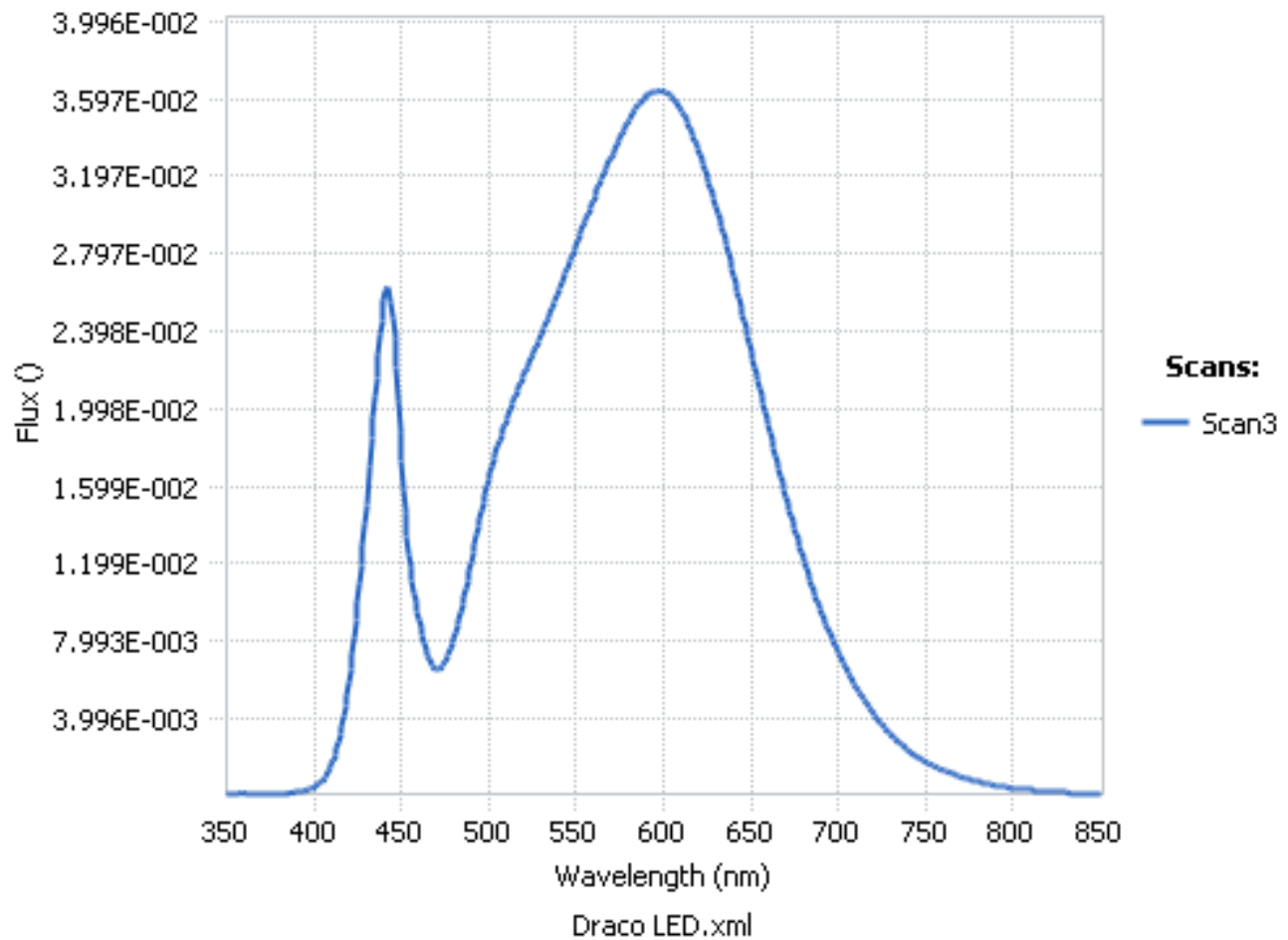


**BS730LED36WWT35120-277VXXX**

Test Results –								
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).								
Key Photometric Results	Sample Reference							
	BS730LED36WWT35120-277VXXX							
	Integrating Sphere				Goniophotometer			
Luminous Efficacy (Lumens/Watt)	57.30				57.03			
Total Luminous Flux (Lumens)	2056				2035.92			
Total Radiant Flux (Watts)	6.449							
Correlated Color Temperature (CCT)	3493							
Color Rendering Index (CRI) (Ra)	82.1							
R1 thru R7 Value	79.9	86.4	92.9	82.7	80.3	82.5	86.2	
R8 thru R14 Value	65.8	13.5	69.2	81.9	69.6	80.7	95.8	
Chromaticity (Chroma x / Chroma y)	0.4079 / 0.3972							
Chromaticity (Chroma u / Chroma v)	0.2348 / 0.3429							
Chromaticity (Chroma u' / Chroma v')	0.2348 / 0.5143							
Duv Value	0.00222							
Stabilization Time (Light and Power)	Approx. 45 minutes							
Total Run Time – Integrating Sphere	49 minutes							
Total Run Time – Goniophotometer	85 minutes							
Spacing Criteria	0.52 (0° – 180°) / 0.52 (90° – 270°)							
Scotopic/Photopic ratio $\Phi(v')/\Phi(v)$	1.476							
Electrical Input Results:	Sample Reference							
	BS730LED36WWT35120-277VXXX							
	Integrating Sphere				Goniophotometer			
Input Power (Watts)	35.88 (35.62)				35.7			
Input Voltage (Volts AC)	120.0 (277.0)				120.25			
Input Current (Amps)	0.31 (0.17)				0.30			
Input Frequency (Hertz)	60				60			
Power Factor	0.960 (0.971)				0.960			
Total Harmonic Distortion (%THD V/A)	0.11 / 8.65 (0.11 / 12.76)							
Additional Information	Sample Reference							
	BS730LED36WWT35120-277VXXX							
Ambient Temperature	24.9°C							
Integrating Sphere Detector	CDS 600 Spectroradiometer							
Absorption Correction used?	Yes							

## Spectral Flux

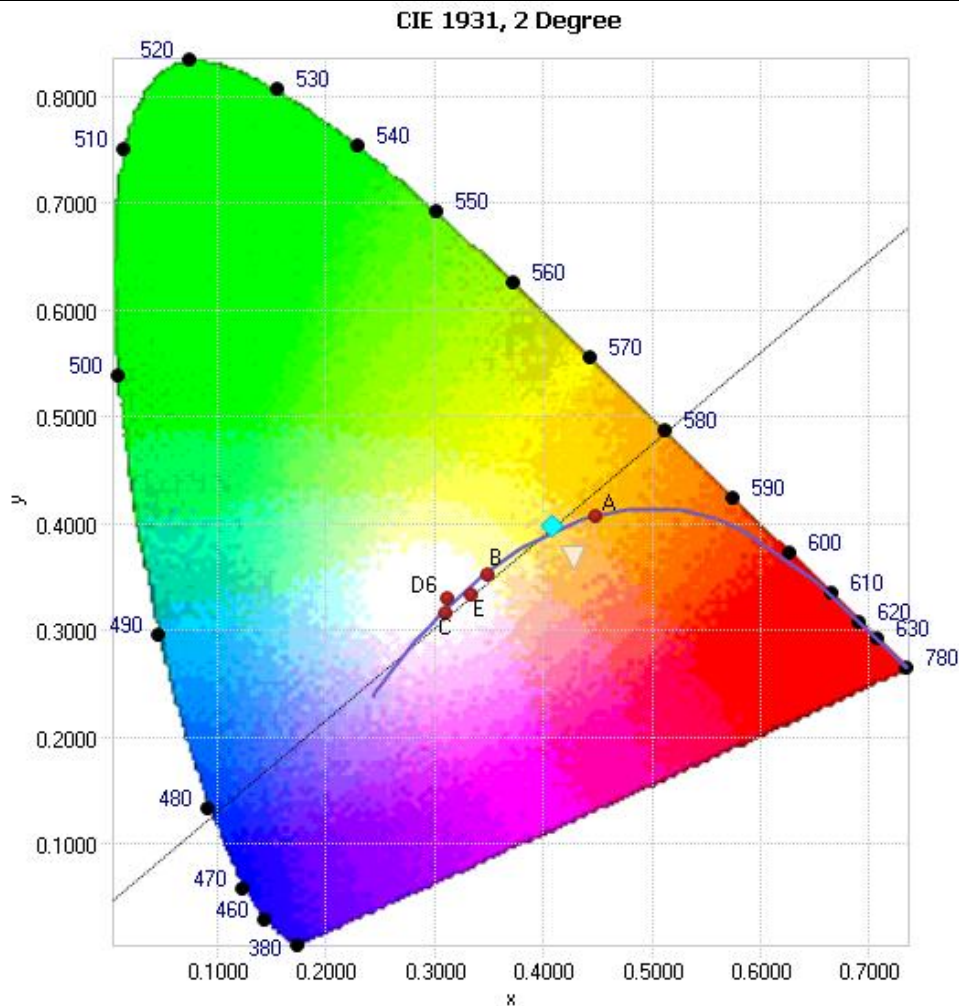
The following graph shows the spectral response curve of the radiant flux for the sample:



**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):**

**$x / y = 0.4079 / 0.3972$**

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>
0 - 10	501.9	24.70%
10 - 20	913	44.80%
20 - 30	462.6	22.70%
30 - 40	124.4	6.10%
40 - 50	18.2	0.90%
50 - 60	5.2	0.30%
60 - 70	3	0.10%
70 - 80	1.6	0.10%
80 - 90	0.5	0.00%
90-100	0.7	0%
100-110	0.2	0%
110-120	0	0%
120-130	0	0%
130-140	0.2	0%
140-150	1	0%
150-160	1.5	0.10%
160-170	1.4	0.10%
170-180	0.5	0%
<b>Total</b>	<b>2035.9 Lumens</b>	<b>100%</b>

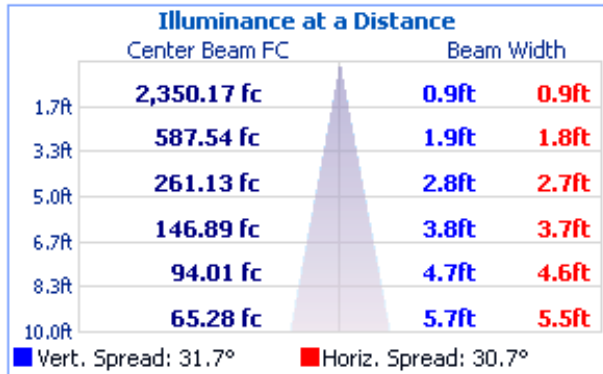
**Zonal Lumen Summary**

<b>Zone</b>	<b>Lumens</b>	<b>% Lamp / Luminaire</b>
0-60	2,025.40	99.50%
60-90	5	0.20%
0-90	2,030.40	99.70%
90-180	5.5	0.30%
0-180	2,035.90	100%

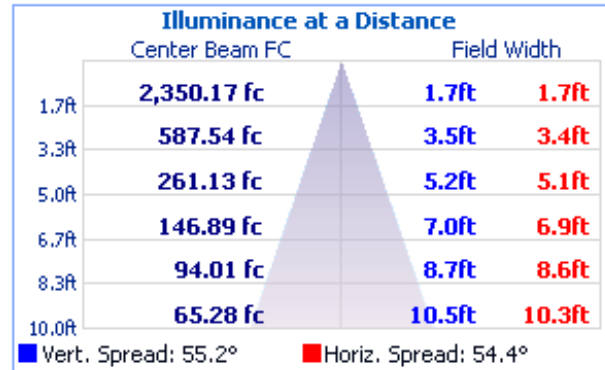


### Test Results – Illuminance Plots

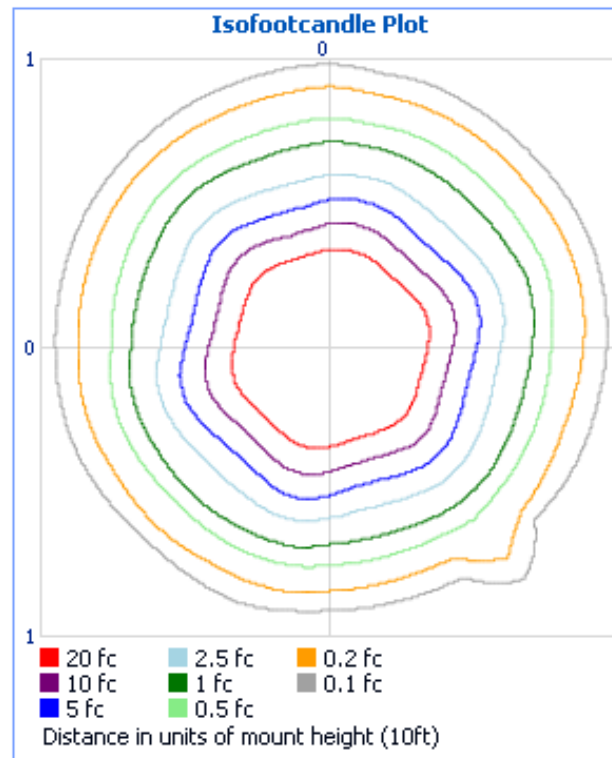
The following images depict the illuminance characteristics of the luminaire.



Beam Angle



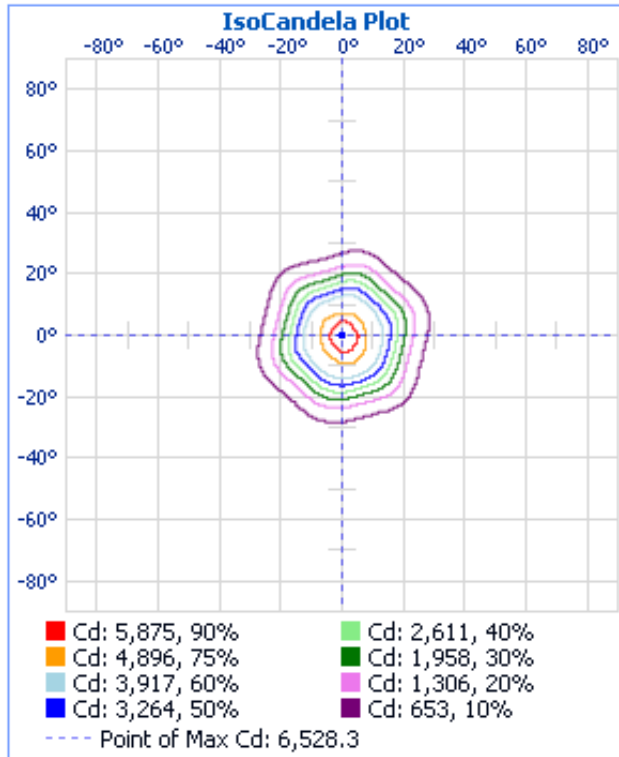
Field Angle



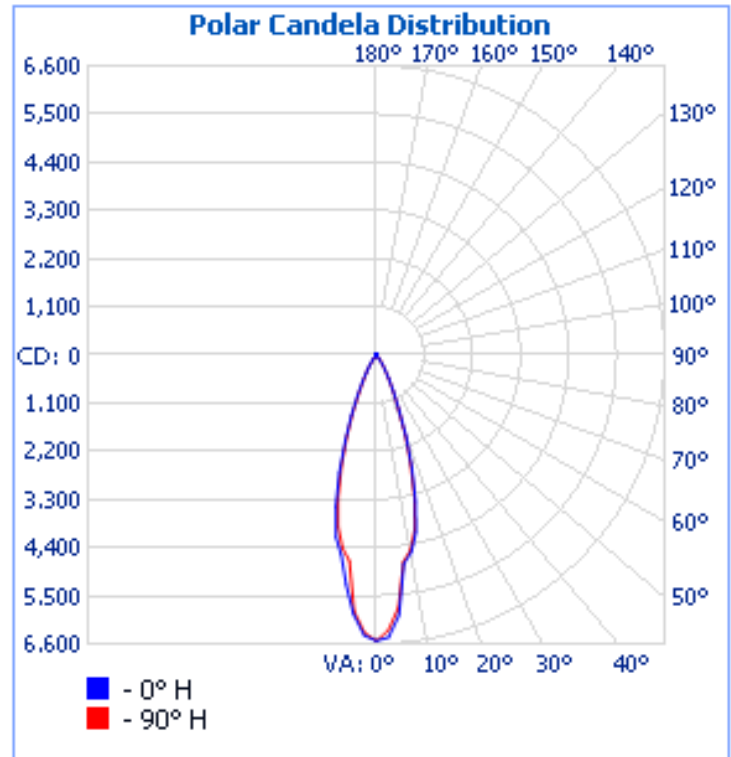
Illuminance Plot (Footcandles)

## Test Results – Candela Plots

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



Isocandela Plot

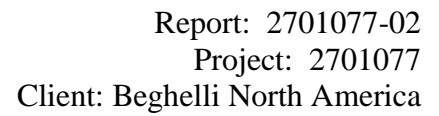


Polar Candela Distribution

## 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	50	30	20	50	30	20	0			
RCR: 0	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	1.00			
1	1.15	1.12	1.10	1.08	1.12	1.10	1.08	.96	1.06	1.05	1.03	1.02	1.01	1.00	.99	.98	.97	.96			
2	1.10	1.06	1.03	1.00	1.08	1.05	1.02	.92	1.02	.99	.97	.99	.97	.95	.96	.94	.93	.91			
3	1.06	1.01	.97	.94	1.04	1.00	.96	.88	.97	.94	.92	.95	.93	.90	.93	.91	.89	.88			
4	1.03	.97	.92	.89	1.01	.95	.91	.85	.93	.90	.87	.92	.89	.86	.90	.87	.85	.84			
5	.99	.92	.88	.85	.97	.92	.87	.82	.90	.86	.83	.88	.85	.83	.87	.84	.82	.81			
6	.96	.89	.84	.81	.94	.88	.84	.79	.86	.83	.80	.85	.82	.79	.84	.81	.79	.78			
7	.92	.85	.80	.77	.91	.85	.80	.76	.83	.79	.77	.82	.79	.76	.81	.78	.76	.75			
8	.89	.82	.77	.74	.88	.81	.77	.73	.80	.76	.74	.79	.76	.73	.79	.75	.73	.72			
9	.86	.79	.74	.71	.85	.79	.74	.70	.78	.74	.71	.77	.73	.71	.76	.73	.71	.69			
10	.84	.76	.72	.69	.83	.76	.72	.68	.75	.71	.68	.74	.71	.68	.74	.70	.68	.67			



The following table provides the tabulated Candela measurements:

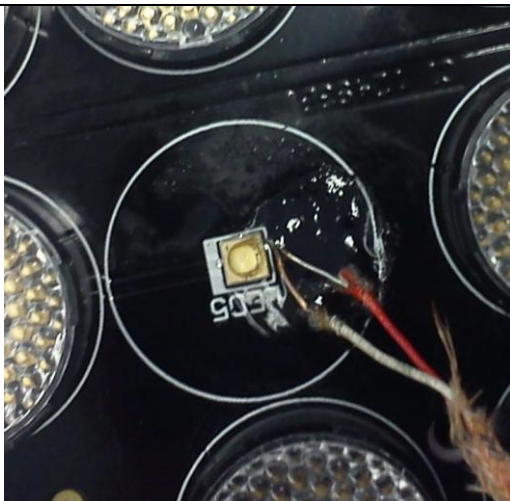
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 www.csagroup.com      Page 11 of 15

## In Situ Temperature Measurement:

### Test Overview

- The sample was tested in the CSA Atlanta, GA lighting laboratory at a regulated and controlled ambient temperature of  $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$
- Data was taken on a Fluke 54II calibrated to ISO 17025
- The sample was powered continuously from a conditioned 120.0V AC Source (60 Hertz).
- Temperature data was recorded after 7 hours of operation (stabilization).
- $T_c$  was monitored using a J-Type thermocouple on the manufacturers designated temperature measurement location as shown in the photographs above:

Thermocouple Location	Temperature Measured ( $^{\circ}\text{C}$ )
LED Junction / Driver	80.0 / 57.3
Ambient	25.0



TC Location on LED



TC Location on Driver

**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 “ $4\pi$  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:

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

<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	11/2014
<b>Equipment List: Sphere D Equipment</b>			
<b>Description</b>	<b>Manufacturer and Model Number</b>	<b>CSA Instrument Reference Number</b>	<b>Calibration Due Date</b>
Integrating Sphere 109"	Labsphere LMS760	SPH400	N/A
Spectroradiometer	Labsphere CDS1100	N/A	N/A
Auxiliary Lamp PSU	Labsphere LPS100	LPS100	N/A
Power Analyzer	Yokogawa WT210	PA108	5/2014
Regulated Power Supply	Chroma Instruments 61603	N/A	N/A
<b>Equipment List: In Situ Temperature</b>			
Thermometer (Thermocouple)	Fluke 54II	TH109	8/2014

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