

PHOTOMETRIC TESTING & EVALUATION

Sample Tested
DECALITE-12 (3000K VERSION)

Prepared for:

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**Technical Report Number
70133088**

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Approved by:



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This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government

Program Description

Photometric and electrical testing of a “DECALITE-12 (3000K VERSION)” fixture.

Executive Summary

Sample Tested = **DECALITE-12 (3000K VERSION)**

Luminous Efficacy* (Lumens/Watt)	Luminous Flux* (Lumens)	Input Power* (Watts)	Power Factor*
59.74	448.1	7.50	1.00

CCT (K)*	CRI*	Stabilization Time (Light & Power)
3149	83.91	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:

Man-D-Tec: DECALITE-12 (3000K VERSION)

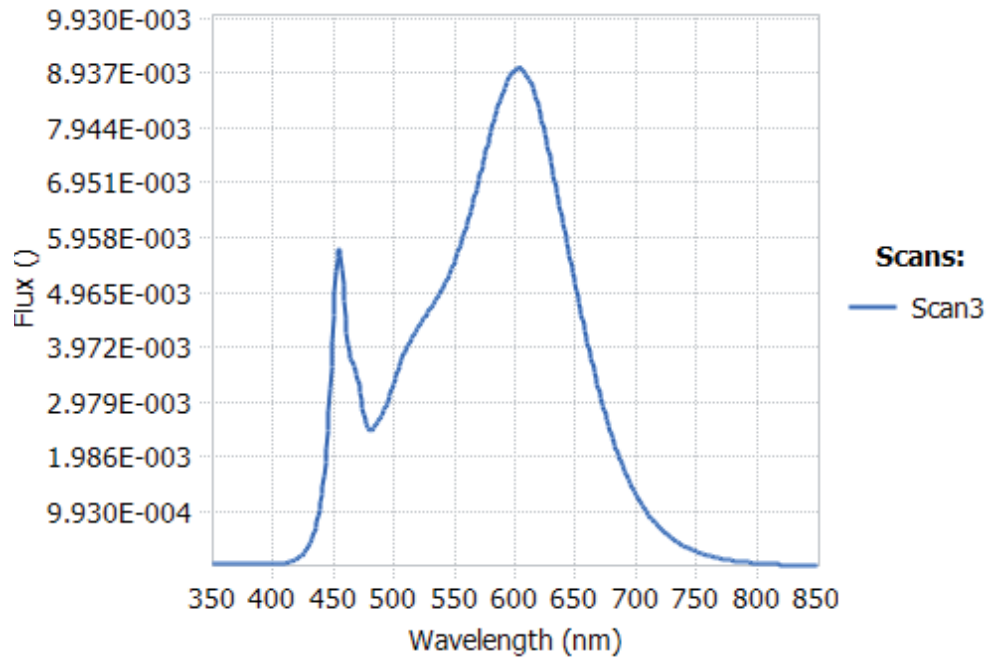


DECALITE-12 (3000K VERSION)

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%.		
Key Photometric Results	Sample Reference	
	DECALITE-12 (3000K VERSION)	
	Integrating Sphere	Goniophotometer
Luminous Efficacy (Lumens/Watt)	59.74	59.91
Total Luminous Flux (Lumens)	448.1	449.3
Total Radiant Flux (Watts)	1.37	
Correlated Color Temperature (CCT)	3149	
Color Rendering Index (CRI) (Ra)	83.91	
R9 Value	11.94	
Chromaticity (Chroma x / Chroma y)	0.4262 / 0.3994	
Chromaticity (Chroma u / Chroma v)	0.2456 / 0.3453	
Chromaticity (Chroma u' / Chroma v')	0.2456 / 0.5179	
D _{uv} Value	0.0006	
Stabilization Time (Light and Power)	Approx. 60 minutes	
Total Run Time – Integrating Sphere	64 minutes	
Total Run Time – Goniophotometer	68 minutes	
Spacing Criteria	1.26 (0° – 180°) / 1.28 (90° – 270°)	
Scotopic/Photopic ratio $\Phi(v')/\Phi(v)$	1.45	
Electrical Input Results:	Sample Reference	
	DECALITE-12 (3000K VERSION)	
Input Power (Watts)	7.50	
Input Voltage (Volts DC)	24.08	
Input Current (Amps)	0.31123	
Input Frequency (Hertz)	60.0	
Power Factor	1.00	
1Additional Information	Sample Reference	
	DECALITE-12 (3000K VERSION)	
Ambient Temperature	25.3°C	
Integrating Sphere Detector	CDS 1100 Spectroradiometer	
Absorption Correction used?	Yes	

Spectral Flux

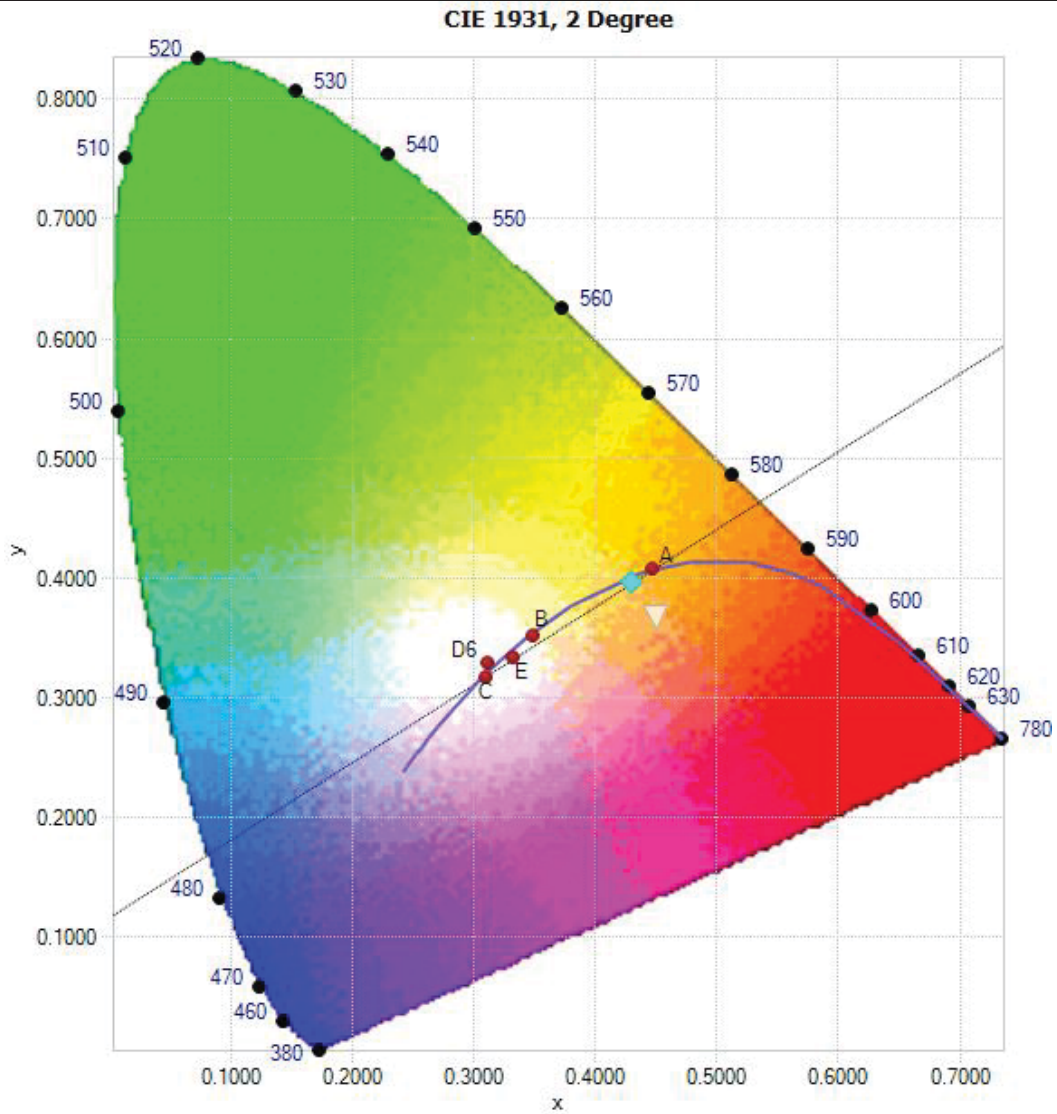
The following graph shows the spectral response curve of the radiant flux for the sample:



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):
 $x / y = 0.4262 / 0.3994$

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:

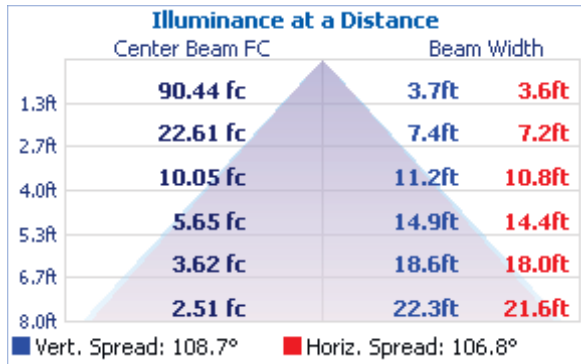
Zone	Lumens	% Total
0-10	15.3	3.4%
10-20	44.0	9.8%
20-30	65.8	14.6%
30-40	78.5	17.5%
40-50	81.2	18.1%
50-60	72.8	16.2%
60-70	54.7	12.2%
70-80	30.0	6.7%
80-90	6.9	1.5%
Total	449.3 LUMENS	100%

Zonal Lumen Summary

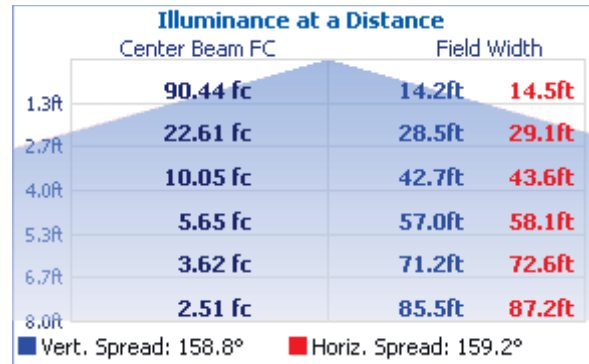
Zone	Lumens	% Luminaire
0-30	125.2	27.9%
0-40	203.7	45.3%
0-60	357.6	79.6%
60-90	91.7	20.4%
0-90	449.3	100%

Test Results – Illuminance Plots

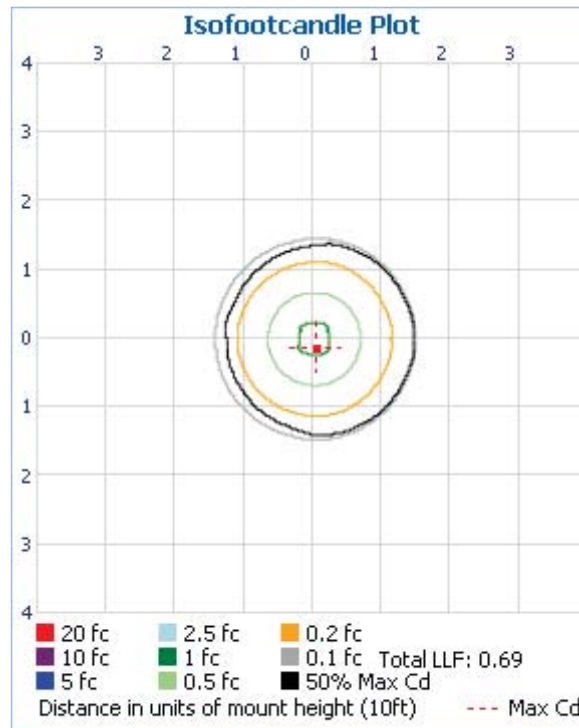
The following images depict the illuminance characteristics of the luminaire.



Beam Angle



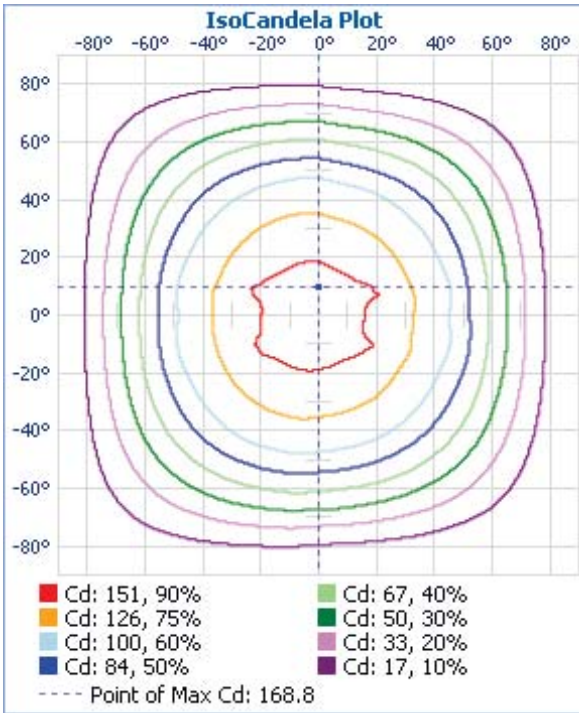
Field Angle



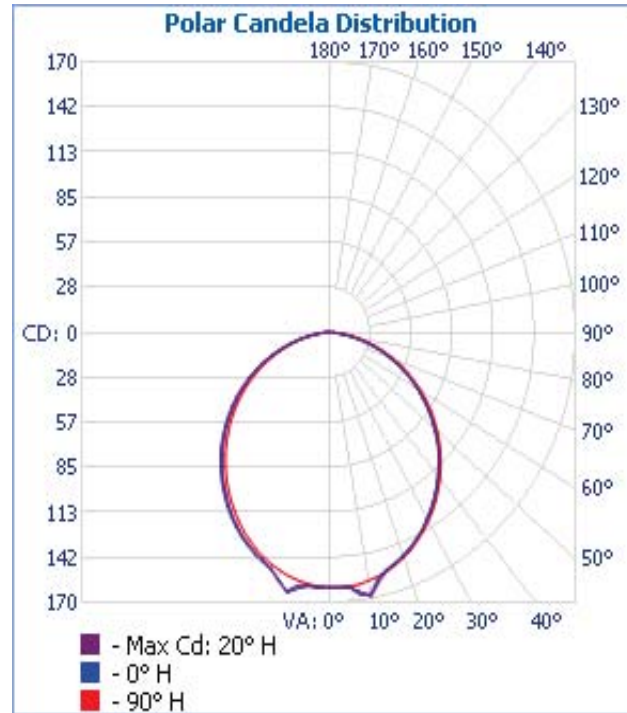
Illuminance Plot (Footcandles)

Test Results – Candela Plots

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



Isocandela Plot



Polar Candela Distribution

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	1.09	1.04	1.00	.96	1.06	1.02	.98	.85	.98	.94	.92	.94	.91	.89	.90	.88	.86	.84
2	.99	.91	.84	.78	.96	.89	.83	.71	.85	.80	.76	.82	.78	.74	.79	.75	.72	.70
3	.90	.80	.72	.65	.88	.78	.71	.61	.75	.69	.63	.72	.67	.62	.70	.65	.61	.59
4	.83	.71	.62	.55	.80	.69	.61	.52	.67	.60	.54	.65	.58	.53	.62	.57	.53	.50
5	.76	.63	.54	.48	.74	.62	.54	.45	.60	.52	.47	.58	.51	.46	.56	.50	.46	.44
6	.70	.57	.48	.42	.68	.56	.47	.40	.54	.47	.41	.52	.46	.41	.51	.45	.40	.38
7	.65	.52	.43	.37	.63	.51	.42	.36	.49	.42	.36	.48	.41	.36	.46	.40	.36	.34
8	.61	.47	.39	.33	.59	.46	.38	.32	.45	.38	.32	.44	.37	.32	.43	.37	.32	.30
9	.57	.43	.35	.29	.55	.43	.35	.29	.41	.34	.29	.40	.34	.29	.39	.33	.29	.27
10	.53	.40	.32	.27	.52	.39	.32	.26	.38	.31	.27	.37	.31	.26	.37	.31	.26	.25



Test Results – Candela Tabulation

The following table provides the tabulated Candela measurements:

Candela Table - Type C

	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	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	161	
2.5	161	161	161	161	161	161	161	160	161	161	161	161	161	161	161	161	161	161	161	161	161	160	160	160	160	160	160	160	160	160	160	160	160	160	160	161	161	161	161	
5	161	161	161	161	160	160	160	160	160	160	161	161	161	161	161	160	160	160	160	160	160	160	160	159	159	159	159	159	159	159	159	159	159	159	159	159	160	160	161	161
7.5	166	166	165	163	161	160	160	160	160	160	160	160	160	160	160	160	160	161	163	162	161	159	159	158	157	157	157	158	158	158	158	158	158	159	161	164	166	167	166	
10	167	168	169	168	165	161	159	159	159	159	159	159	159	159	161	163	165	166	166	166	165	163	160	157	156	156	156	156	156	156	156	157	162	165	166	165	164	167		
12.5	158	159	161	164	167	165	159	157	157	157	157	158	158	160	165	166	165	163	159	159	160	163	163	158	154	154	153	154	154	154	154	159	164	162	159	157	156	158		
15	155	155	156	160	165	161	155	156	156	156	156	156	158	163	163	159	156	155	154	154	153	155	158	160	154	151	151	151	151	152	153	160	160	154	153	153	153	155		
17.5	152	153	153	153	154	158	162	155	153	153	154	154	159	161	156	153	153	153	151	151	150	150	151	155	154	148	148	148	148	149	152	158	151	150	150	150	150	151	152	
20	150	150	150	150	151	151	158	154	151	151	151	152	160	154	151	151	150	150	149	148	148	147	146	148	154	146	145	145	146	152	152	146	147	147	147	148	150			
22.5	147	147	147	148	148	152	154	148	148	148	151	155	148	148	148	148	147	147	145	145	144	144	143	143	148	144	142	142	142	151	144	143	143	144	144	144	145	147		
25	143	144	144	144	144	144	145	153	145	145	145	151	148	145	145	145	144	144	142	141	141	140	140	139	141	142	138	138	139	147	139	139	139	140	140	141	143			
27.5	140	140	140	141	141	141	141	149	141	141	141	149	142	141	141	141	140	140	138	137	137	136	136	135	135	139	134	134	135	140	135	135	136	136	137	137	140			
30	135	136	136	137	137	137	137	141	138	137	137	145	137	137	137	137	136	136	134	133	133	132	131	131	130	133	130	130	131	132	131	131	131	131	132	132	133	135		
32.5	131	132	133	132	133	133	133	135	134	133	134	137	133	133	133	133	132	132	130	129	128	128	127	126	125	128	125	125	127	126	126	126	127	128	128	129	131			
35	127	127	128	128	128	128	129	129	130	129	129	130	129	129	128	128	128	127	125	124	123	123	124	121	121	121	121	120	123	121	121	122	122	123	123	124	127			
37.5	122	123	123	123	124	124	124	124	126	124	125	124	124	125	124	124	123	123	120	120	119	118	120	116	116	116	116	116	119	116	116	117	118	119	119	122				
40	117	118	118	118	119	119	119	123	120	121	119	119	122	119	119	118	118	115	114	114	113	112	111	111	111	111	110	115	111	111	112	112	113	114	114	117				
42.5	112	113	113	113	114	114	114	118	115	117	114	114	114	114	114	113	113	112	110	109	108	108	107	106	106	105	107	105	110	106	106	107	107	108	109	112				
45	107	107	108	108	108	109	109	109	113	109	113	109	109	109	108	108	107	107	105	104	103	102	101	101	100	100	102	100	103	100	100	101	101	102	103	104	107			
47.5	102	103	102	102	103	103	103	104	108	104	107	104	103	103	103	103	102	102	99	98	97	96	96	95	94	94	97	94	96	95	95	95	96	96	98	98	102			
50	95	96	97	97	97	97	98	98	101	98	101	98	98	97	97	97	96	96	93	92	92	91	90	89	88	88	91	88	89	89	89	89	90	91	91	92	95			
52.5	89	90	90	91	91	91	92	92	94	92	94	92	91	91	91	90	90	87	86	85	85	84	83	83	82	84	82	82	83	83	83	83	84	84	85	86	89			
55	83	84	84	84	85	85	86	86	87	86	87	86	86	85	85	85	84	83	81	80	79	78	78	77	76	76	77	76	76	77	77	77	78	78	79	80	83			
57.5	77	77	78	78	79	79	79	80	80	80	80	80	79	79	79	78	78	77	75	74	73	72	71	71	70	70	70	70	70	70	71	71	72	73	74	77				
60	70	71	72	72	72	73	73	73	74	73	74	73	73	73	72	72	71	71	68	67	66	66	65	64	64	64	64	63	63	64	64	65	65	66	67	70				
62.5	64	64	65	65	66	66	67	67	67	67	67	67	66	66	66	65	65	64	62	60	60	59	58	58	57	57	57	57	57	57	58	58	59	59	60	64				
65	57	58	58	58	59	60	60	60	60	60	60	60	60	59	59	58	58	57	55	54	53	52	51	51	51	50	50	50	50	51	51	52	52	53	53	57				
67.5	50	51	51	52	52	53	53	54	54	54	54	53	53	53	52	51	51	48	48	46	46	45	44	44	44	44	44	44	44	44	45	46	46	47	50					
70	43	44	44	45	46	46	46	47	47	47	47	46	46	45	45	44	44	41	40	39	39	38	38	37	37	37	37	37	37	38	38	39	39	40	43					
72.5	36	37	37	38	39	39	40	40	40	40	40	40	39	39	38	37	37	34	33	32	32	31	31	31	30	30	30	30	31	31	31	31	32	32	33	36				
75	29	30	30	31	32	32	33	33	33	33	33	33	32	32	31	31	30	27	26	26	25	25	24	24	24	24	24	24	24	24	25	25	25	26	29					
77.5	23	23	24	24	25	26	26	27	27	27	26	26	26	25	24	24	23	21	20	19	19	19	18	18	18	18	18	18	18	18	18	18	19	19	20	23				
80	16	17	17	18	19	19	20	20	20	20	20	20	19	18	18	17	17	14	14	13	13	12	12	12	12	12	12	12	12	12	13	13	13	13	16					
82.5	10	11	11	12	12	13	14	14	14	14	14	14	13	13	12	11	10	9	8	8	8	7	8	7	7	7	7	7	7	7	7	7	7	7	8	10				
85	5	5	6	7	7	8	8	9	9	9	9	9	8	8	7	7	6	5	4	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	5	5				
87.5	1	1	2	3	3	4	4	5	5	5	5	5	4	4	3	3	2	2	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1				
90	0	0	0	0	1	1	1	2	2	2	2	2	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			

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:

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	2.600 Amperes
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.



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	11/2017
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 CDS1100	CDS1100	N/A
Auxiliary Lamp PSU	Labsphere LPS100	LPS100	N/A
Power Analyzer	Yokogawa WT210	PA111	2/2018
Regulated Power Supply	Chroma Instruments 61603	AC302	N/A

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